Tackling European Water Challenges

Coordination and Support Action

FP7 - ENV.2012.6.3-5

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Coordination with activities outside Europe

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1	RVO.nl (Former NL Agency)	Netherlands Enterprise Agency	NL
2	MINECO	Ministerio de Economía y Competitividad	ES
3	IRSTEA	Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture	FR
4	NERC	Natural Environment Research Council	UK
5	ISPRA	Istituto Superiore per la Protezione e la Ricerca Ambiental	IT
6	SUEN	Turkish Water Institute	TR
7	BRGM	Bureau de Recherches Géologiques et Minières	FR
8	MoE	Ministry of Energy and Water Resources	IL
9	JÜLICH	Forschungszentrum JÜLICH	DE

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1. LIST OF ABBREVIATIONS

AECID	Spanish Agency for International Cooperation for Development
AIRD	L'Agence inter-établissements de recherche pour le développement
AITF	Alberta Finland Technology Innovation and Commercialization program
AKA	Academy of Finland
ANR	French Research Agency
ASEM	Asia Europe Meeting
BMBF	German Federal Ministry of Research and Education
BRGM	French Geological Survey
BRL	Brazilian Real
BRICS	Brazil, Russia, India, China, South Africa
CADWES	Capacity Development in Water and Environmental Services
CAPES	Brazilian Federal Agency for the Support and Evaluation of Graduate Education
CAS	Chinese Academy of Science
CASS	Chinese Academy of Social Sciences
CDTI	Spanish Center for Technological Development
CEFIRSE	Indo-French center for research on water sciences
CEH	Center for Ecology and Hydrology
CEREGE	Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement
CFA	Franco American Commission
CII	Confederation of Indian Industry
CIRAD	Center for Agronomic Research for Development
CLIENT	Technologies and Services for Climate Protection and the Environment
CNRS	National Center for Scientific Research

CNSF	Chinese National Science Foundation
COFECUB	French Committee for Evaluation of Academic and Scientific Cooperation
CPLP	Community of Portuguese-Speaking Countries
CSA	Coordination and Support Action
CSIC	Spanish Center for Technological Development
CZO	Critical Zone Observatory
DAAD	German Academic Exchange Service
DBT	Department for Bio Technology
DFID	Department for International Development
DG	Directorate General
DIWALI	Dutch Indian Water Alliance
DST	Department for Science and Technology
EC	European Commission
EECCA	Eastern Europe, Caucasus and Central Asia
ENGREF	French: National School of Rural Water and Forestry Engineering
ENSA	National Advanced School of Agronomy (Algeria)
EPSRC	Engineering and Physical Sciences Research Council
ERA	European Research Area
ERAC	European Research Area and Innovation Committee
ERO	Environmental Research Observatories
ESALQ	Escola Superior de Agricultura Luiz de Queiroz
ESPA	Ecosystem Services for Poverty Alleviation
ESRC	Economic and Social Research Council
EULANEST	European-Latin American Network for Science and Technology
FACEPE	Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco (research funding agency of the State of Pernambuco)
FAPESP	São Paulo Research Foundation

FCO	Foreign and Commonwealth Club
FCT	Portuguese National Funding Agency for Science, Research and innovation
FCTH	Hydraulics Technology Foundation Center
FICCA	Finnish Research Programme on Climate Change
FONA	Research for Sustainable Development
GDP	Gross Domestic Product
GERD	Gross Expenditure on R&D
GITA	Global Innovation & Technology Alliance
GSO	Group of Senior Officials
HYMEX	Hydrological cycle in the Mediterranean Experiment
IAMM	Mediterranean Agricultural Institute of Montpellier
IAV	Institute for Agriculture and Cattle (Morocco)
ICMR	Indian Council of Medical Research
IFCGR	Indo French Center for Groundwater Research
IFCPAR	Indo French Center for the Promotion of Advanced Research
IFP	French Institute of Pondicherry
IGFA	International Group of Funding Agencies
IISc	Indian Institute of Science
INCO	International Cooperation
INCT	National Institute for Science and Technology (Brazil)
INGREF	National Research Institute of Rural Engineering, Water and Forests
INMHA	Canadian Institute of Health Research
INRA	French Research Institute for Agriculture
INSERM	Institut National de la Santé et de la Recherche Médicale
IOF	International Opportunities Fund
IPI	India Pilot Initiative
IRD	French institute for Research and Development

IRN	Indian Research Network
IRSTEA	Research Institute for Environment and Agriculture
IWEGA	International Center for Water Economics and Governance in Africa
IWRM	Integrated Water Resources Management
JPI	Joint Programming Initiative
JCST	Joint Committee for Scientific and Technological Cooperation
JSPS	Japan Society for the Promotion of Science
JST	Japan Science and Technology Agency
KNAW	Royal Netherland Academy of Arts and Sciences
KSA	Key Strategic Area
LTHE	Laboratoire d'étude des Transferts en Hydrologie et Environnement
MBR	Membrane Bio Reactor
MEC	Ministry of Education and Science
MED	Mediterranean Countries
MEM-TEK	National Research Center on Membrane Technologies
MerMeX	Marine Mediterranean Experiment
MESR	Ministry for Research and Higher Education
MINECO	Ministry of Economics and Competitiveness
MIRA	Mediterranean Innovation and Research Coordination Action
MITyC	Ministry of Industry, Tourism and Trade
MISTRALS	Mediterranean Integrated Studies at Regional And Local Scales
MIT	Massachusetts Institute of Technology
MoCo	Monitoring Committee (MoCo) for Euro-Mediterranean cooperation
MOST	Ministry of Science and Technology of Vietnam
MOST	Ministry of Science, Technology and Space (Israel)
MoU	Memorandum of Understanding
MRE-ABC	Brazilian Ministry of External Relations

MS	Member State
MST	Ministry of Science & Technology (India)
NEPAD	New Partnerships for Africa's Development
NERC	UK National Environment Research Council
NGRI	National Geophysical Research Institute (India)
NIH	National Institute of Health (US)
NISTEP	National Institute of Science & Technology Policy (Japan)
NOW	The Netherlands Organisation for Scientific Research
NPP	Networking Pilot Programme
NRC	National Research Council of Canada
NSC	National Science Council of Taiwan
NSERC	Natural Sciences and Engineering Research Council of Canada
NSF	National Science Foundation (US)
NSFC	National Natural Science Foundation of China
OMERE	Long Term Environmental Research Observatories
OS&T	Office for Science and Technology
PA	Per Annum
PAC	Programme for Acceleration Growth
PACEIM	Programme to aid the creation of innovative enterprises in the Mediterranean
PASRI	Support programme for research and innovation systems
PICASS-EAU	Predicting the Impact of Climate and practices on water resources in sub-Saharan Africa
PICS	International Programme of Scientific Cooperation
PSEM	Countries south and east of the Mediterranean
RAS	Russian Academy of Sciences
RBV	Catchment network in France
RCEES	Research Center for Eco Environmental Sciences

RCUK	Research Councils UK
RDI	Research, Development, Innovation
RDTI	Research, Development, Technology and Innovation
RFBR	Russian Foundation for Basic Research
RFH	Russian Foundation for Humanities
R&I	Research and Innovation
SASI	South Africa and Spain Innovation Programme
SEED	Sino-French program for Environment and sustainable Development
SICMed	Continental Surfaces and Interfaces in the Mediterranean area
SIRMA	Irrigated Systems in North Africa
SFIC	Strategic Forum for International S&T Cooperation
SME	Small and Medium Enterprise
SNRI	National Strategy for Research and Innovation
SRIA	Strategic Research and Innovation Agenda
S&T	Science & Technology
STI	Science, Technology Innovation
TEKES	Finnish Funding Agency for Innovation
TORCH	High Tech Industry Development Center Ministry of Science & Technology
UKIERI	UK India Education and Research Initiative
UMR	Joint Research Unit (IRSTEA France)
USGS	US Geological Survey
USP	Sao Paulo University
USTO	University Mohamed Boudiaf (Algeria)
WMA	Water Management Areas
WSPI	Water Science and Policy Institute

2. EXECUTIVE SUMMARY

Limitations in the common European strategy for international RDI cooperation in water related issues have often led to duplication of effort, with resulting inefficient use of resources and reduced impact. Increased coordination will benefit both Europe and partners outside Europe. Key WP5 objectives include:

I. Strengthening the international dimension of European Water RDI.

II. Developing durable partnerships for Water RDI in the world.

A more coordinated and consistent approach in international water RDI cooperation between European Member States will help build the critical mass needed to provide an effective response to major societal challenges as formulated in the Water JPI Vision Document. It will also enable Europe to participate more effectively in agenda setting in international water fora and to convey consistent messages.

Two tasks were defined to reach both objectives:

5.1 Mapping Water RDI initiatives run by Water JPI partners outside Europe.
5.2 Develop and sustain strategic alliances outside Europe.

Nine WatEUr partners, gathered in WP5, made an analysis of the current situation in water RDI cooperation outside Europe (WP5.1). The first part of this report integrates all these analyses.

The WatEUr partners were asked to give an overview of their priority countries, international programmes, budgets and topics of cooperation in water. As a result, there are a total of 27 countries outside Europe where Water JPI Partners have cooperation with. Countries which were mentioned most are India, China, USA, Brazil, Canada, Vietnam and Morocco.

These results were presented during the Water JPI Executive Board meeting in Venice in October 2013. During this meeting it was decided that the third countries **Brazil, USA, Canada, South Africa, India, China and Vietnam** will be further analysed. This does not mean that other countries or regions are excluded. The Mediterranean region for example is for most southern countries in Europe of strategic importance and they can probably be given a follow up in the near future.

In the second part of WP5.1 a detailed analysis is made on the above mentioned countries concerning 1) scientific publications between EU and specific third countries 2) market analyses and 3) per country a detailed survey in which major water challenges are described including a detailed description of major funding organizations.

This thorough analysis gives insight information on the degree of water RDI, water market perspectives and the opportunities for collaboration. In some cases, for example, the water RDI landscape is fragmented which makes it more complicated to create strategic alliances with the Water JPI.

This report will give the Water JPI basic information in order to select countries outside Europe which will create added value for the Water JPI. Target countries will be selected following a number of criteria, based on mutual interest and mutual benefit. These criteria can be:

- Synergies in the production of specific and technological breakthroughs;
- Information exchanges on specific research and development needs;
- Technology adaptation to local conditions;
- Pilot testing European technology and;
- Internationalization of policy developments in water management.

In the second task of the WatEUr WP5 work-package (WP 5.2) strategic alliances will be formed and letters of intent will be signed with specific countries outside Europe.

A major aspect in the collaboration with third countries is that not every Water JPI country has tied with a specific third country and in some cases Water JPI partners see certain constraints for collaboration outside Europe. These constraints could be: competition, preference for bilateral vs. multilateral cooperation, intellectual property rights issues or the lack of national policy support. These are important issues that need to be addressed.

One of the fundamentals of the Water JPI is the so called "variable geometry". This gives maximum flexibility for individual Water JPI partners in choosing topics and partners for collaboration. In this way, the Water JPI creates maximum added value for the partner countries.

3. INTRODUCTION

Over the past decade the RDI landscape has evolved rapidly. Global research and innovation were until recently dominated by the European Union, the USA and Japan. As the emerging economies continue their research and innovation systems a multipolar system is developing in which countries such as Brazil, China, India and South Korea. The share of the BRICS in global expenditure on R&D doubled. For example since 1999, China's spending on R&D has grown 20 percent annually to more than $100 billion. By 2020, China plans to invest 2.5 percent of GDP in research. For the USA the investment in R&D was already 2.8 % of GDP in 2012[1].

Research and innovation are increasingly interlinked internationally, aided by rapidly developing information and communication technologies. The number of internationally co-authored scientific publications and the mobility of researchers are increasing. Research organizations are even establishing offices abroad and companies are investing outside their home countries, in particular in the emerging economies.

Global challenges are important drivers for research and innovation. Our planet has finite resources which need to be cared for sustainably; climate change and infectious diseases do not stop at national borders, food security needs to be ensured across the globe. The Union needs to strengthen its dialogues with international partners to build critical mass for tackling these challenges.

As more research and innovation is performed in third countries, the Union will need to access this knowledge based on the principle of reciprocity. To remain a major global player, the Union must promote itself as an attractive partner for carrying out research and innovation and be successful in the global competition for talent, while at the same time preserving its economic interests, for instance as regards the protection of intellectual property. Foremost there is an urgent need for a collaborative and integrated strategy for international cooperation in STI.

The main goal of the Water JPI is cooperation in research, development and innovation within Europe in order to be more efficient. The efforts of the Water JPI community are directed to societal challenges. And as the European research and innovation community is already rather well organised, the Water JPI acts as a mechanism to remove interferences, support innovations in the research community itself, etc.

Besides the cooperation within Europe, the Water JPI intends also to seek for cooperation with countries outside Europe. The question is why should it do so? What kind of countries are of interest and what is the added value for the research community. Actually, there are a number of important benefits, motivations and enabling factors that help explain the growth of international collaboration in research, including: 1) greater impact; 2) scientific discovery; 3) scale of research projects; 4) scope and complexity of research topics and international issues; 5) capacity-building; 6) advances in technology and communications; and 7) tackling global societal challenges. The added value can easily be illustrated by an example:

[1] www.Globalsherpa.org

Like in many European countries India is facing water scarcity. One of the solutions is desalination of brackish and sea water. The challenge for India is to produce on a very low cost, because water is mostly not metered. So there is no consumers' payment by quantity. In Europe research is more oriented to technology improvement and not necessarily to cost, but with the growing problem of water scarcity it is interesting indeed to see how the cost aspect can be considered in further research and how the European research community can benefit of the Indian research.

This example, which can easily be extended with other examples, shows that there is a self-interest for European countries to cooperate in the research and innovation area with countries outside Europe. Besides, science is pre-eminently driven by curiosity without any boundary. Even if it is mentioned quite often as a risk, the cooperation with countries having a same scientific level and a comparable economic position has a positive added value. At least, one can always learn from each other, or even from coalitions.

3.1 WATER JPI in the field of cooperation outside Europe

Based on the preceding information the cautious conclusion is the cooperation outside Europe could pay off. And in fact cooperation does happen already. At different levels, from national until EU there are more or less organized initiatives.

Bilateral cooperation at national level

Most Water JPI partners have one or more strategic bilateral partnerships outside Europe. Besides, these partnerships on national level, individual Institutes also have their short list for strategic collaboration with Institutes in third countries. The added value is that it gives maximum freedom for the individual EU Member States to work on national priorities and policy with third countries.

European Commission, structure and strategy for collaboration with third countries.

At European level, the **Strategic Forum for International S&T Cooperation** (SFIC) is an advisory body to the Council and the Commission with a view to implementing a European Partnership in the field of international scientific and technological cooperation (STI cooperation). EU Member States, the Council and the Commission are members of the Forum while EU Associated Countries are observers. SFIC's objective is to facilitate the further development, implementation and monitoring of the international dimension of the European Research Area (ERA) by the sharing of information and consultation between the partners with a view to identifying common priorities which could lead to coordinated or joint initiatives, and coordinating activities and positions vis-à-vis third countries and within international fora.

SFIC is developing initiatives on China, India, USA, and Brazil and there are plans for Russia, and African Union. Main issue is to explore the grounds for cooperation with third countries, to prepare decision making documents for bilateral agreements and to draft joint roadmaps for STI cooperation.

Why to strive for international cooperation

From the point of view of knowledge and technology, strengthening the European knowledge position based on basic research, applied research and innovation should be an important criteria. Cooperation can create joint solutions for societal challenges and mutual economic benefits. Further on, it is very important to consider that cooperation is not a hit and run. The added value must come from long term collaboration, focusing on the mutual strong points in order to create mass. Mass

also means that a potential partner should have a similar research capacity as the Water JPI. There must be a balanced partnership. Finally, there is the issue of IPR. The rules about IPR must be clearly stated in any cooperative agreement with third countries.

How to achieve the international ambition of the Water JPI

It was a deliberate decision of the Water JPI partners to extend the research cooperation within Europe to countries outside Europe. The above mentioned examples clearly illustrate the reason for this decision.

The question is: How should the Water JPI attain this international scope? Is it by setting up its own structures and instruments or would it be wiser to join existing structures? For the India case it is obvious that a choice for participating in the GSO structure is inevitable.

Collaboration with countries outside Europe should be a decision of individual EU Member States in upcoming calls and activities. This goes back to the variable geometry of the Water JPI in which JPI partners can choose topics and partners in order to gain maximum added value.

4. EUROPEAN COMMISSION AND SFIC IN RELATION TO THE WATER JPI

SFIC

SFIC is a Strategic Forum on International Cooperation and an advisory body to the Council and the Commission with a view to implementing a European Partnership in the field of international scientific and technological cooperation (S&T cooperation). EU Member States and the Commission are members of the Forum while countries associated to H2020 have an observer ship status. The objective for Member States and the European Union is to define together priority research and technology areas where a coherent effort would generate more added value than bilateral activities. Currently the Member States and the European Union are involved in a myriad of research cooperation activities with non-EU countries. Joining forces in relevant areas will help increase the impact of the pursued activities, optimise the use of available resources and avoid duplication of efforts. Better coordination between Member States and the European Union is needed to address global challenges such as climate change, food and water supply or energy security, and to promote the corresponding European policy goals and a global sustainable development.

SFIC Initiatives

SFIC is currently developing activities with **China, Brazil and USA**. With **India** a pilot initiative is currently running.

China

SFIC is working on a roadmap for the development of a more coherent and strategic EU/Member States approach towards cooperation vis-à-vis and with China. In this context the EU and the Members States are identifying priority areas for joint initiatives such as the interoperability of bilateral programmes, funding schemes and rules (including IPR issues).

USA

In October 2009 SFIC agreed to develop an initiative amongst industrialised countries with the USA as a pilot. Information on bilateral S&T cooperation was collected from all partners via a questionnaire. Based on this survey SFIC identified four issues in which a joint EU/ MS initiative would create added value:

- **Mutual opening of programmes** and **intensifying programmatic cooperation** as a key objective. This is particularly relevant in energy research in which the EU/ US Energy Council identified this as a priority. It is closely linked to the Innovation Union flagship initiative's commitment 31 to contribute to the establishment of a level playing field with third countries.
- **Raising the attractiveness of Europe's research landscape** in the USA and achieving more balanced transatlantic mobility and knowledge flows is an interest of common concern of Member States and the EU where a joint approach will raise visibility and competitiveness of Europe's research.
- **Establishing a transatlantic space of open innovation** is closely linked to the two issues above meaning barrier-free mutual access to knowledge, to support schemes for start-up firms and entrepreneurs, to venture capital, to high tech clusters and incubators on both sides.
- **Developing strategic intelligence:** The US is both, a partner of cooperation and a competitor in the global contest for talents and ideas; analysis of the US ST&I profile and of US cooperation

patterns with global partners (like China) will improve the EU's activities vis-à-vis third countries.

Brazil

The SFIC plenary decided in 2013 to launch a SFIC initiative on Brazil.

The concept paper outlines the following steps:

- Collect information on EU/MS/AC S&T activities towards and with Brazil, including mobility schemes in collaboration with the network of science counsellors in Brazil.
- Analyse the variety of on-going successful cooperation activities and identifying where overlaps exist. Recommend areas where there is potential for a more coordinated European approach vis-à-vis Brazil which would add value to existing successful cooperation activities.

Pilot Initiative on India

The India Pilot Initiative on water and bio-resources challenges was launched at the Delhi EU/MS-India Stakeholders conference in November 2010. As one of the components of the India pilot initiative, the Commission launched in July 2011 two water-related coordinated calls with India equally funded by the two sides. As a result, some MS/AC intensified their cooperation activities with India in the field of water and bio-resources. To bring the process to a higher, more comprehensive and strategic level, SFIC decided in 2011 to work on a **draft strategic agenda** outlining a broader range of common challenges, objectives, priority areas and instruments for EU/MS-India cooperation for the coming years.

For the SFIC India Pilot Initiative, which is currently being further developed, an organizational structure called GSO (Group of Senior Officials (at directors level)) is launched. The specific mechanisms for the support structure for the Group of Senior Officials are not yet established (Figure 1).

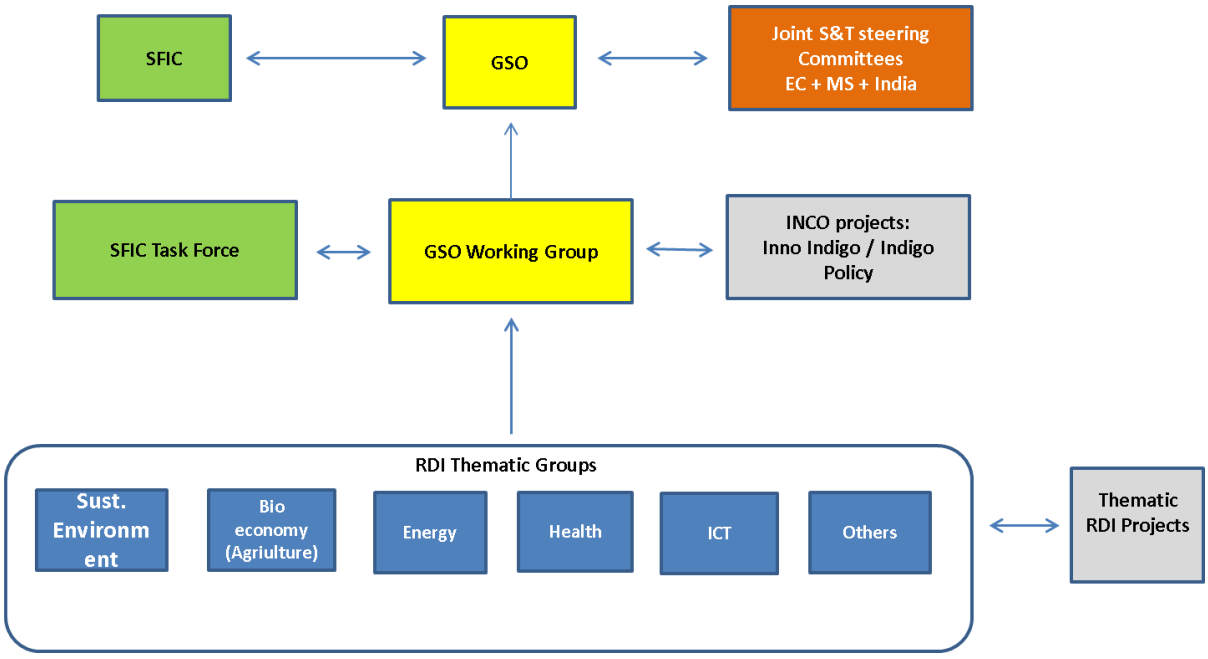

Figure 1 - Proposed GSO governance structure for India

Initially, three Thematic Groups will be established – Water, Energy, and Health. These groups will be co-chaired by one MS and one representative from India, being open to interested MS and supported by respective DG´s of the EC. The tasks proposed include mapping of existing initiatives, fine-tuning of the shared R&I agenda and propose a roadmap for action for the specific theme, organizing/supervising workshops and brokerage events.

For the implementation of policy within the India Pilot Initiative the INDIGO POLICY PROJECT is launched in December 2012. INDIGO POLICY will act as a Secretariat for the Thematic Groups and will do data analyses and organization of thematic meetings between EU and India.

ERA-Net INNO INDIGO

The main objective of the horizontal ERA-Net with India under FP7 is to enhance the European-Indian STI cooperation. The first ERA-Net New INDIGO (2009 -2013) has successfully implemented schemes for joint multilateral calls for proposals. These calls have developed from simple networking and mobility funding towards the funding of research projects with Small and Middle size enterprises (SME) involvement. It is already obvious that the running ERA-Net contributed to certain extend to lessen the fragmentation of the European Research Area (ERA) and, more important, to a fostered network with their most important Innovation related approaches: in the focus of INNO INDIGO are the involvement of SMEs/Industries as well as Clusters / Networks of Excellence / Competence

Combining the European and Indian key aspects of innovation INNO INDIGO deals with three types of innovation:

- Business driven Innovation for boosting competitiveness.
- Social innovation covering societal challenges and needs
- Inclusive innovation targeting the Indian social challenges and needs and opening new ways of collaboration

INNO INDIGO will be successful when becoming a common platform for European and Indian funding organizations to finance **jointly research and innovation, especially for EU countries that do not have bilateral programmes with India** and develop visions on new forms of collaboration. Regarding Policy driven, INNO INDIGO will translate political decisions from different sources (EU-MS, India Government, Regions, SME-Associations, SFIC and the GSO) into practical and tangible funding mechanisms.

More information can be found at Newindigo.eu.

International cooperation in H2020

…….at the same time, the EU should aim to strengthen international cooperation also with emerging economies, especially ***China and India****, through strategic partnerships in the field of water. This will allow for joint development of technological solutions that, capitalising on the mutual knowledge and experience of the water industry in EU Member States and these countries, have a great potential for further replication and market uptake. Building on its leadership in international water-related negotiations, the EU will promote its experience in water policy and river management in order to share best practices.*

http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-climate_en.pdf

Scope: Proposals shall address only one of the following issues:

b) [2015] A coordination platform *for scientists, decision makers, practitioners and other key stakeholders representing a number of* ***African countries*** *throughout the duration of Horizon 2020 to identify opportunities and constraints for the sustainable management of water and other natural resources and ecosystems and for the development of cost-effective climate change adaptation and mitigation measures in* ***Africa.*** *In line with the EU's strategy for international cooperation in research and innovation35 international cooperation is encouraged,* ***in particular with Africa***

Type of project: CSA

Deadline: March 10, 2015

c) [2015] Development of water supply and sanitation technology, systems and tools, and/or methodologies *to manage risks associated with water supply and sanitation and cross-boundary water management issues, or integrated water resources management systems for sustainable agriculture and food security, sustainable environment protection and economic growth, focused on the* ***non-EU Mediterranean countries and Africa****. Proposals should connect to local knowledge, socio-economic development cultures, policy institutions and implementing bodies, and take into account the gender dimension where relevant. In line with the EU's strategy for international cooperation in research* and innovation36 international cooperation is encouraged, in particular with non-EU Mediterranean countries and Africa. Proposals should include participation of organisations from the above-mentioned regions.

Type of project: Research and Innovation Action

Deadline: March 10, 2015

5. INTERNATIONAL ACTIVITIES OF WATER JPI PARTNERS OUTSIDE EUROPE

5.1. Introduction

This section describes the Water RDI programmes and activities of Water JPI partners outside Europe. Water JPI partners were asked to give their information about the strategic priority countries outside Europe from a national point of view (so not from the individual organizations involved in the Water JPI). Water JPI partners selected those countries where they have strategic alliances and agreements with on water RDI. Figure 2 shows the total overview about strategic alliances with countries outside Europe. Following, a detailed description of individual Water JPI partners on their collaboration outside Europe is given.

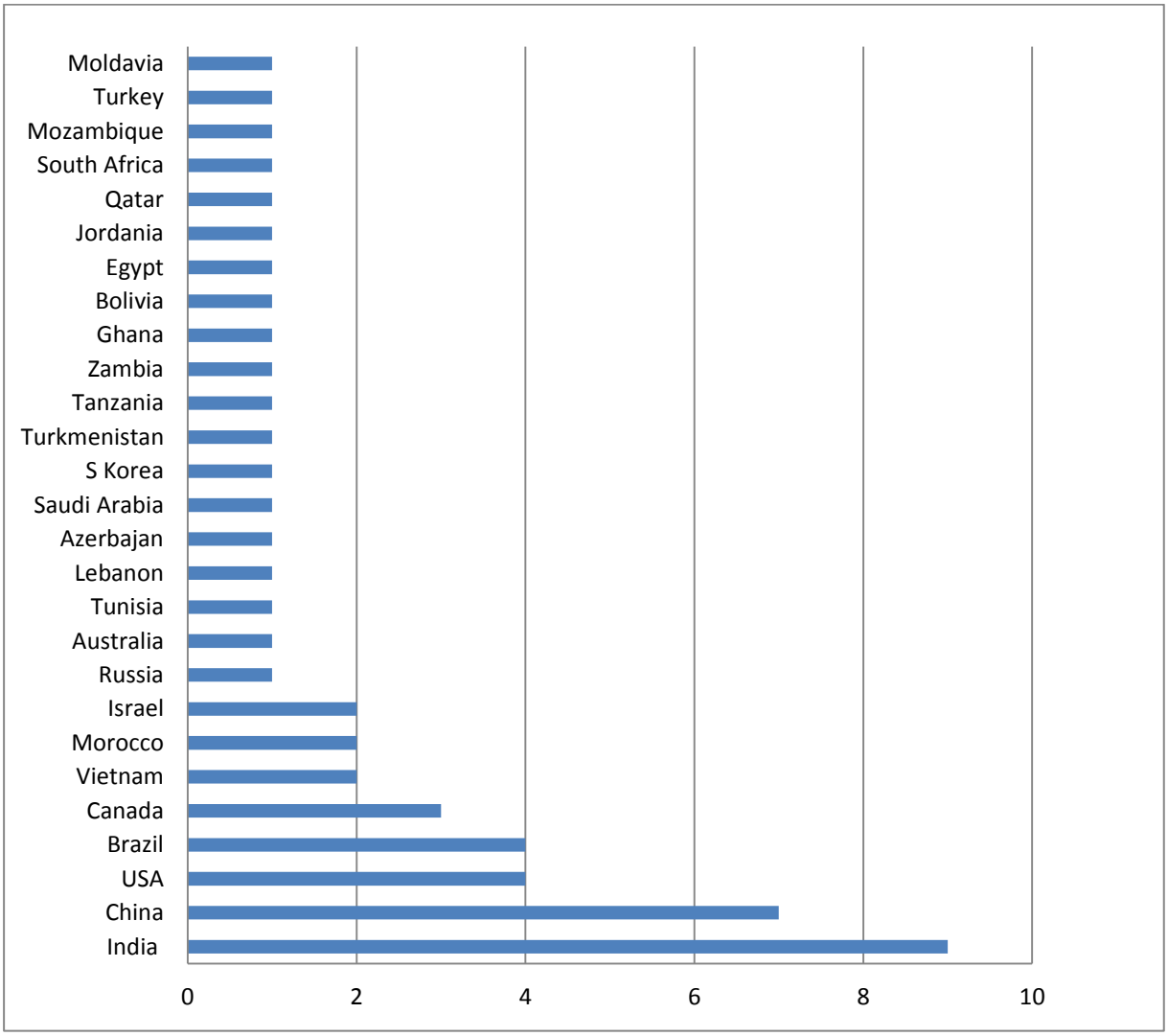

Figure 2 - Countries identified by Water JPI partners

5.2. France, Strategic priority countries

In 2009, the **Ministry for Research and Higher Education (MESR)** defined its national strategy for research and innovation (SNRI) at international level on five strategic issues:

- Strengthen the role of France and Europe in the global scientific fora
- Increase the attractiveness of France for researchers
- Develop policy development of public and private international research
- Intensify cooperation with international research partners, particularly emerging countries (Brazil, China, India, Russia), Japan and South Korea
- Placing research for development

The **French Research Agency ANR** under MESR governance signed bilateral agreements with foreign agencies allowing researchers to initiate or strengthen their international cooperation. The procedures and field of activities differ from country to country. In 2014, all bilateral agreements formerly supported by thematic programs and open (White) calls are now concerned by the generic call and the selection occurs through a two-step procedure. Only few bilateral programs are open on water issues.

India	France is currently the fifth scientific partner of India, and has decided to strengthen its cooperation with this country, as it has been identified as a priority country for the international component of the National Strategy for Research and Innovation (SNRI). Several reports were prepared in 2012 to evaluate the status of scientific and technological cooperation with India as well as to propose a strategic action plan : At their meeting in January 2012, the French Minister for Higher Education and Research and the Indian Deputy Minister of Science, Technology and Earth Sciences wished to strengthen cooperation between their countries in **Water and Innovation**, among the five priority areas of science, technology and innovation.. The National Research Agency (ANR) strengthens joint programs established with its Indian partners on a reciprocal basis (the last call was launched in 2013, with strong orientation on engineering regarding water). The French **Research Institute for Agriculture, INRA,** coordinates an IFCPAR trans-disciplinary project dedicated to integrated **water management** at catchment level, coupling crop, hydrological and economical models, to test the effect of irrigation in groundwater level and crop production, including retroactive effect. Remote sensing is extensively used to calibrate crop models and to determine soil properties. **IRD,** The French Institute for Research and Development (IRD), has a long lasting cooperation with the Indian Institute of Science (IISc) in Bangalore since 2000, with the creation of the **Indo-French center for research on water sciences (CEFIRSE)**. Recently, this joint center has been transformed into an international laboratory gathering IISc scientists and several French Research units with numerous scientific tutorships from IRD (CNRS, CNES, INRA, Universities, etc.). The joint laboratory is working on **water issues** at catchment scale, including spatial hydrology (atmosphere – ocean –water cycle) and social sciences. In 2010, both ministers for Education, Research and Technology signed a MoU. Besides the financing of

	experts in India, activities are supported by projects funded through competitive call for proposal supported by the French Agency for Research (ANR), CNES, as well as scientific programs of the Ministry for Higher Education and Research. The French geological survey, **BRGM**, signed a MoU with the National Geophysical Research Institute in 2000. A joint center, called **Indo French Center for Groundwater research (IFCGR)** is operating since then on NGRI campus in Hyderabad. Researchers, projects and field studies are funded by both institutions, mainly in the field of groundwater management under global and climate changes. Additional funding is obtained through competitive calls for proposals lead by the French Agency for Research (ANR) and by FP7, for example SaphPani and SARASWATI projects regarding reuse of water and recharge process. Between 2007-2013, two ANR projects were funded, MOHINI dealing with the geochemical processes leading to observed fluoride concentrations in hard rock aquifers and SHIVA that aims at assessing the vulnerability of groundwater users in a context of global change (climate and socioeconomic changes) The first **National Center for Scientific Research (CNRS) office in India** opened in New Delhi on February 2011, in order to strengthen relationships with Indian institutional partners. CNRS has already signed cooperation agreements with the **Indian Ministry of Science and Technology** (with departments "Science and Technology", "Biotechnology" and "Scientific and Industrial Research"). CNRS also has two joint units in India of French research institutes abroad (CNRS / Ministry of Foreign and European Affairs), four international associated laboratories and an international research group. Together with other scientific partners (IRD and INRA in France, CEFIRSE and Indian Institute of Science – IISC – in Bengalore), CNRS contributes to the Tropical Experimental Watershed programs for providing environmental dataset on water biogeochemical variations and the matter transfers in ecosystems at watershed scale. The **research institute for environment and agriculture, IRSTEA,** has been exchanging with India on irrigation technologies (capacity building). A collaboration is built within the FP7 SWINGS project "Safeguarding resources in India with green and sustainable technologies"with several Indian partners (e.g. Banaras Hindu University, University of Kalani, Biotech India, and Center for sustainable technologies). Research groups joining several French laboratories, called **Joint Research Units (UMR)** are involved into collaborations with Indian partners. For example, three French Joint Research Units (Rennes, Toulouse and Avignon) collaborate with Indian Institute of Science – IISC – and ATREE in Bangalore. **UMR G-Eau** (IRSTEA, IRD, ENGREF, CIRAD) is currently present in India at the French Institute of Pondicherry. One of the so-called International Program of Scientific Cooperation (PICS) involves for example ECOLAB UMR 5245 of Toulouse and Manipal Institute of Technology on "Assessment of water and carbon cycles, rock weathering and river water pollution using stable isotopes". **Scope:** most of collaboration is **applied research / innovation / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in water industry, implementing a water-wised bio-based

	economy, closing water cycle gap. **Estimated budget p/y:** > 1 M€
China	Franco-Chinese scientific and technological cooperation is old. It is based on solid anchor points such as joint research structures. Capacity and quality of scientific output make China very attractive for research. It becomes an essential partner to address major scientific and environmental challenges. France and China have agreed at the **Joint Scientific and Technical Committee** in May 2011 to strengthen scientific and technological cooperation on topics that reflect the priorities of the national strategy for research and innovation. Among these priorities, 50% have a concern on water issues, i.e. Sustainable development, biodiversity and water management, and chemicals. The pluridisciplinary SEED program (Sino-FrEnch program for Environment and sustainable Development) is coordinated by **CNRS** and open to various scientific, institutional and private actors. It is based on the long lasting cooperation (since 1978) with the **Chinese Academy of Sciences** (CAS) and aims at coordinating sino-french activities in the field of environment and sustainable development, including coastal management and water resources. More than 100 researchers have been participating to this program. In China, the **French Research Agency ANR** has two main partners: the **Chinese National Science Foundation of China (CNSF)** since 2008, with more than 50 projects on various technological areas, as well as the environment, and **the Ministry of Science and Technology (MOST)** since 2007, with a program on ecotechnologies between 2010 and 2013. In the area of water, those two programs financed 2 projects on Ecotechnology and Water), some of them with funding over 1 M€. A large collaborative program between European Countries and South East Asian Countries was supported in 2005 by the **FP6 INCO program**. BRGM acted as co-coordinator of ASEMWaterNet, Multi-Stakeholder Platform for ASEM S&T "Cooperation on Sustainable Water Use", which has been funded to promote science and technology co-operation between Europe and Asia on water resource management by focussing on the five main issues that were identified at the 1st ASEM workshop in Changsha: River-basin management, Water-use efficiency in agriculture, Floods, Pollution, Governance and strengthening the links between knowledge and action. In line with this first project and based on the principles of equality, opening-up and mutual benefits, the **ASEM Water Resources Research and Development Center** was officially founded in Changsha, Hunan, China in 2011 in the framework of ASEM. On one side, this Center aims to: i) strengthen regional collaborations, ii) facilitate the establishment of a long-term partnership among Asia-Europe water resources research institutes, iii) develop research network, and iv) create synergies through cooperative research, in a bid to jointly address common concerns about water use and water environment governance. On the other side, the Center will submit policy recommendations and technical consultations to ASEM as well as Asian-European states and governments on sustainable water use

	and integrated management, strategic planning and action plans. http://www.asemwater.org/AboutASEMWater/. China is also a priority for **CIRAD** the Center for Agricultural Research for Development. **IRSTEA** is participating in the Global Climate Forum/ Global System Sciences Group and Integrated Risk Governance project » of the Beijing Normal University. Contacts have been established on water treatment technologies with the Tongji University, Shanghai Jiao Tong University and the China Research Academy of environmental science. In the hydrology area, IRSTEA and the Wuhan University are part of the consortium for the FP7 project HYDRATE "Hydro meteorological data resources and technologies for effective flashflood forecasting". Bilateral agreements for education and research development are signed between numerous universities and research centers. **Scope:** most of collaboration is **applied research / innovation / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, implementing a water-wised bio-based economy, closing water cycle gap **Estimated budget per year:** 1 M€
Mediterranean non EU countries	Mediterranean countries are part of the geo strategy of **IRD** and **INRA**. This African and Mediterranean priority concerns particularly sensitive topics, such as water resources and terrestrial and coastal eco-systems. **IRD** has collaborated for more than 50 years with the Mediterranean countries (MED), nowadays through three offices, covering eight countries. The programmes respond to strategically prioritized research areas in the countries south and east of the Mediterranean (PSEM) including the knowledge and development of natural resources and environmental protection As well as being committed to these programs, IRD is engaged in Euro-Mediterranean institutional organizations and activities (MoCo, ERAnet, MIRA-Spring, etc.) IRD contributes to fundamental research and long-term monitoring of the environment, including water, through the Mediterranean environment monitoring project (OREME). Three IRD research units collaborate within the OREME (Hydro Sciences Montpellier HSM, Écologie des systèmes marins côtiers ECOSYM, Institut des sciences de l'évolution de Montpellier ISE-M) on topics such as water and soil resources, natural risks and vulnerability, observation and modelling tools. Coordinated by **CNRS and IRD** and in partnership with several institutions around the Mediterranean sea, the MISTRALS program (Mediterranean Integrated STudies at Regional And Local Scales) is a ten-year observation and interdisciplinary research project dedicated to understanding the processes at work in the Mediterranean Basin, as well as global change, whether natural or human-induced. Its ultimate goal is to predict the evolution of habitability conditions in this eco

region and propose appropriate measures to optimize them. About 300 French and as much foreign researchers take part to the MISTRALS program In the field of water, several projects gather a large partnership, such as:

- HyMeX (Hydrological cycle in the Mediterranean Experiment) focused on evolution and predictability of extreme events in the perspective of climate change.
- MerMeX (Marine Mediterranean Experiment) focused on biogeochemical changes.
- SICMed (Continental Surfaces and Interfaces in the Mediterranean area) is dedicated to eco-anthroposystems of rural and peri-urban areas.

INRA is highly involved in Mediterranean countries, specifically in Tunisia and Morocco. INRA manages the Long Term Environmental Research Observatories (ERO), called as OMERE, which is mainly dedicated to catchment hydrology and erosion, and is included in RBV (Catchment network in France). Observation is the support for modelling and water management to control water recharge to groundwater and soil conservation. Programs are developed under MISTRALS programmes.

BRGM coordinated the INCO- MEDITATE project about integrated water management for limited water resources in Mediterranean countries (Jordan, Lebanon, Syria, Turkey) considering specifically the use of alternative water resources such as submarine springs, desalination and/or water reuse including development of a decision support system that will allow to integrate different types of knowledge (from physical to socio-economic fields), inclusive all social actors, in a decision making processes.

The Mediterranean area is going to be a priority area for research at **CIRAD** (Center for Agronomic Research for development) on integrated and territorial management of water, irrigated and groundwater systems. Researches (about 10) are working in Morocco, Tunisia, Egypt, and Saudi Arabia. Main activities include scientific and technical support. A well-known network **SIRMA** "Water economy for irrigated systems in Maghreb", has been created in 2004 with other French institutions (IRSTEA, IRD).

Involvement of CIRAD researchers is increasing on education in engineering schools and universities.

IRSTEA, in particular within its Joint research Unit UMR Geau, is involved with non-European Mediterranean countries for more than 20 years, mainly in the field of sustainable water management in agriculture. Strategic partners are INRGREF in Tunisia, IAV Hassan II in Morocco, and ENSA in Algeria. IRSTEA is part of the above mentioned RCP SIRMA Project, in collaboration with CIRAD, IRD, Agro Paris Tech, Sup Agro Montpellier, and IAMM in France. Furthermore, IRSTEA is participating in the FP7 EauforFood project (KBBE 2011-2015, European union and African union cooperative research to increase food production in irrigated farming systems in Africa), and the ANR Project ARENA (2012, 2015 Analyse de la résilience des nouvelles formes d'agricultures irriguées à partir des eaux souterraines au Maghreb). In the hydrology area, teams of IRSTEA Lyon are

	collaborating with the USTO and Oran University of Es-Senia Algeria). **Scope:** most of collaboration is **applied research / mobility** **Connection to Water JPI SRIA:** developing safe water systems, closing water cycle gap **Estimated budget per year:** 1 M€
Brazil	The French **Institute for Research and Development IRD** is collaborating with Brazil for over 50 years and since 1979 has a permanent representation in Brasilia. Water is included in the main areas of action of the IRD in Brazil. From 1982, all research projects developed are conducted in the framework agreement **IRD-CNPq**, including hydrology and, geochemistry. Projects with high technical component are carried out under the framework of specific agreements with the Brazilian Cooperation Agency of the Brazilian Ministry of External Relations (MRE-ABC), such as projects with EMBRAPA and the ANA. Cooperation is in force between the French Research Agency ANR and various agencies since 2008 on different programs (bioenergy in 2008, biodiversity in 2011). A further Memorandum of Understanding between Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), and Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco (FACEPE) from Brazil, and Agence Nationale de la Recherche (ANR) from France was signed to launch Calls for Joint Research Projects. Between 2010 and 2013, **FAPESP, FACEPE and ANR** funded collaborative research and innovation projects in Global Change in the framework of the "SOC&ENV PROGRAM – Facing Societal and Environmental Changes". In 2014, "Respectful management of resources and adaptation to change" is open on marine research. IRSTEA has established several scientific partnerships with Brazil in the fields of irrigation technologies with INCT Engenheria Irrigação and ESALQ, management of water distribution networks with the Universities of Santa Catarina and Federal University of Mato Grosso, hydrological modelling with Universities of Rio Grande do Sul Minas Gerais and São Paulo. An important project is being conducted in São Paulo with the Fundação Centro Tecnológico de Hidráulica (FCTH) and the French NOVIMET company with the goal of installing a new hydro meteorological radar and its rain processing software, and thus improving the monitoring and the management of hydrology risks over the metropolitan area of São Paulo (funding from FASEP program, France). **Scope:** most of collaboration is **applied research /mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap, implementing water wise bio based economy **Estimated budget p/y:** 1 M€

Central and West Africa	Central and West Africa has been for a long time a priority area for **IRD.** One of the projects called "Forecasting water resources in the Sahel for 2050" has been launched for the Bani, a main tributary of the River Niger. The aim is to make projections for 2050 under a variety of different climatic and socio-economic scenarios. It involves the IRD in partnership with various joint research units of CIRAD, IRSTEA (formerly Cemagref), the CNRS and Engref, plus several French universities and higher education establishments and Malian partners including Bamako University, the Bamako National Engineering School and the Malian national hydrological and meteorological authorities. The **PICASS-EAU international joint laboratory** (Predicting the Impact of Climate and practices on water resources in sub-Saharan Africa) was established in 2012 by the University of Ngaoundere Cameroon, the International Institute of Engineering of the water and Environment in Burkina Faso, the University of Rouen, and IRD. In France additional laboratories are associated to the laboratory (CEREGE, G-EAU, and LTHE). Research objectives are: • Quantification of water fluxes in the soil- vegetation system• Interactions surface water - groundwater• Deterioration of the quality of water resources **Scope:** most of collaboration is **applied research / mobility** **Connection to Water JPI SRIA:** developing safe water systems, closing water cycle gap, implementing water wise bio based economy **Estimated budget per year:** < 1 M€
South Africa and Southern Africa	The **International Opportunities Fund (IOF)** is a joint funding call between the **IGFA/Belmont Forum** and G8 Heads of Research Councils (G8HORCs) for approximately 20 M €. The countries involved in this initiative, currently, are Australia, Brazil, Canada, France, Germany, India (pending), Japan, Russia, South Africa, the United Kingdom, and the United States of America. This IOF is aimed at supporting excellent research on topics of global relevance best tackled through a multinational approach, recognizing that global challenges need global solutions. Funding should support researchers to cooperate in consortia consisting of partners from at least three of the participating countries and must bring together natural scientists, social scientists and research users (policy makers, regulators, NGOs, communities and industry). In 2012, the IOF supported research in the field of coastal vulnerability and freshwater security. **IRSTEA**, in particular within its joint research unit UMR GEau, is involved in several European and international projects in partnership with South Africa in particular in water management and governance issues : • FP7 project **AFROMAISON** "Africa at meso-scale: Adaptive and integrated tools and strategies on natural resources management" (www.afromaison.net/) with the South African partners Institute for National Resources and Université du Kwazulu Natal. • **Eau 4 Food** "European Union and African Union cooperative research to increase Food production in irrigated farming systems in Africa"

	(http://www.eau4food.info/) with CSIR and Stellenbosch University • FP7 **Wetwin** project "Enhancing the role of wetlands in integrated water resources management for twinned river basins in EU, Africa and South-America in support of EU Water Initiatives" (http://www.wetwin.eu/) with IWMI (GCRAI), and the University of Limpopo • **International Opportunities Fund/ Belmont Forum project MAGIC** "Multi-scale adaptations to global change and their impacts on vulnerability in coastal areas" coordinated by the Nelson Mandela Metropolitan University. Furthermore, IRSTEA is collaborating with the University of Cape Town in the area of sustainable operational management for Water distribution networks. **Scope:** most of collaboration is **applied research / mobility** **Connection to Water JPI SRIA:** developing safe water systems, closing water cycle gap, implementing water wise bio based economy **Estimated budget per year:** < 1 M€
USA	Bilateral actions are channels of scientific cooperation among the most productive, both in Europe and in the world. This is particularly the case with the United States is the first country with which France cooperates. Cooperation between researchers is conducted at the initiative of researchers themselves. Most of cooperation is funded directly by the laboratories. The French Ministry of Higher Education and Research, often associated with the Ministry of Foreign and European Affairs, launches calls for proposals to boost cooperation in original thematic fields. Long term monitoring on soil and water is organized in US by the Critical Zone Observatories network (CZO). Strong links have been established between CZO US network and RBV (French catchment network) which is labelled as a SOERE, managed by CNRS, and including sites from CNRS, INRA, IRD and IRSTEA. United States is a strategic partner of **IRSTEA**. Numerous collaborations are conducted via common projects, co-supervision of students, doctoral and post-doctoral fellows, and joint scientific publications. At the institutional level, IRSTEA has signed a Memorandum of Understanding with the US Geological Survey USGS (wFww.usgs.gov , 2008). Specific areas of cooperation with USGS in the water area are: • Biology and ecology of aquatic ecosystems: ecotoxicology of freshwater ecosystems, fisheries and migratory fish ecology, • Water resources and hydrologic investigations: hydrological data and water flow forecast models, experimental sites and observatories, • Support to governance and decision making processes: water resources management and governance. The Joint Research Unit **UMR G-Eau** collaborates since 2009 with the Water Science and Policy Institute (WSPI) based at the University of California Riverside. This collaboration extends further, as the director of the institute is a member of the IWEGA Advisory Board. IWEGA is the International center for Water Economics and Governance in Africa, based at the University E Mondlane in

	Maputo. G Eau is co-founder of IWEGA. A common project is currently underway within the group Resilience Alliance and particularly with the Arizona State University. A number of research exchanges took place in the last five years during which G Eau researchers were hosted by research and training institutions in U.S.A, namely Berkeley University and USGS/MIT. **Scope:** most of collaboration is **applied research / innovation / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, implementing a water-wised bio-based economy, closing water cycle gap **Estimated budget per year** 1 M€
Canada	http://www.ambafrance-ca.org/France-Canada-Research-Fund Quebec is one of the first scientific partners of **IRSTEA** at international level. The province is among the main areas of destination and origin for the mobility of researchers, and the first partners of international co-publications. IRSTEA signed MoUs with Laval University, INRS, Université du Québec à Montréal and HydroQuébec. Areas of collaborations in the water domain are various such as: • Optimization of wastewater treatment, • Quality of aquatic systems, • Hydrology, • Safety of hydraulic structures. Beyond Québec, IRSTEA is conducting joint research projects in the area of quality of aquatic systems, in particular with Environment Canada. Canada is a strategic partner of **INRA** on water resource (quantity and quality). Numerous joint research projects are developed on aquatic ecosystem health. The Joint Research Unit **UMR G-Eau** is currently discussing the possibility to launch a program of research collaboration with the University of Laval in the following fields: • Hydro sciences, • Agronomy and water uses, and • Life sciences and water. **Scope:** most of collaboration is **applied research / innovation / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, implementing a water-wised bio-based economy, closing water cycle gap **Estimated budget per year:** 1 M€

South-East Asia	Increased research exchanges are supported by **CIRAD** in South-East Asia, especially with Vietnam (University of Sciences and Technology of Hanoï) on education in the field of water and environment.

5.3. Spain, Strategic priority countries

Canada	Canada and Spain are engaged in an active cooperation relationship based on mutual interests and values, both in multilateral and bilateral questions. The regional relationships between some Canadian provinces and Spanish autonomous communities are also very dynamic. Close bilateral collaboration in the area of Science and Technology between the two countries has led to significant joint initiatives of interest. The National Research Council of Canada (NRC) and the Spanish National Research Council (CSIC) have worked together for many years in key areas of research, such as health, renewable energy and the environment. Research in marine biology, particularly ecosystems and fishing practices, represents a common priority of their bilateral cooperation. It is also in the interest of both countries to commence collaborative research projects in the areas of aquiculture and agri-food. CDTI and NRC-CNRC (Canada) signed in November 2005 an agreement focusing on the establishment of a Bilateral Technological Cooperation Program. The objective of this program was to promote the Entrepreneurship Technological Cooperation between Spanish and Canadian entities, in technology transfer projects, technological development and innovation, to generate profit for Spain and Canada. This was a bottom-up programme, with no specific mention to Water or other topics. This agreement has been continuously updated to face the evolution of the technological cooperation between Spain and Canada. In fact, since June 2012, Canada became an associated country of Eureka Programme (multilateral cooperation programme also with a bottom-up philosophy). This new status has made that the support of technological market-oriented projects between Spanish and Canadian firms has moved from the Bilateral Programme framework to Eureka. Within the Eureka framework, there are Clusters, which are technology driven. One of these Clusters is Acqueau. The main aim is to facilitate the generation of market driven, international collaborative water research and technological development RTD projects for the benefit of the Water Industry. Entities from Both Spain and Canada have shown interest in this initiative which is supported by CDTI and NRC. **Scope:** most of collaboration is applied research / innovation / technological development **Connection to JPI SRIA:** Linked to Acqueau through EIP Water **Estimated budget p/y:** -
China	Spain and China signed a collaboration agreement in RDI on May 2013. The agreement establishes that each country will give access to scientific infrastructures and researchers Exchange. The main interest areas are Biotechnology, Energy, Environmental protection (water included), Health and ICT. Spain and China closely cooperate in science, technology and innovation. Specific fora and bilateral seminars are being organized. The Spanish-Chinese Bilateral Technological Cooperation Program (**Chineka**), managed by the **Centre for Industrial Technological Development (CDTI)** in Spain and the **High-Tech**

	Industry Development Center Ministry of Science and Technology (TORCH) in China, promotes international technological cooperation between Spanish and Chinese partners through projects leaded by companies with the objective of boosting their competitiveness by encouraging and supporting the implementation of joint technological projects oriented to development and/or adaptation of new products, processes or services for international markets. The approach of this program is bottom-up, with no concrete areas of interest. **Scope:** applied research /innovation/technological development **Connection to JPI SRIA:** promoting competitiveness in industry **Estimated budget p/y:** -
Ibero America	MINECO has agreements on cooperation with several countries, included Brazil, at bilateral and multilateral level through CYTED programme. This programme cover various research fields related to environment, included water research, and it is devoted to support joint projects, based on annual call for proposals. The IBEROEKA projects help to fund business technological cooperation in Ibero-America. This initiative is included within the Ibero-American Science and Technology for Development Programme (CYTED) in which 19 countries from South and Central America, Portugal and Spain take part. Iberoeka is characterized by an essential, bottom-up principle, whereby participants are free to use their own criteria in order to formulate, develop and budget RDi projects considering their own needs. The CDTI, as the Spanish manager of the Iberoeka projects, **fosters the participation** of Spanish companies in this initiative, advises on the submission of new proposals, on the search for partners and on access to funding sources. There are no close spaces that frame the innovative initiative of companies and research centres. On the contrary, participants can undertake projects adapted to their specific needs so long they meet some basic requirements. Besides, CDTI has also Specific ad-hoc bilateral agreements for cooperation on R&D activities under the Iberoeka principles with the following countries: México, Argentina, Chile, and will be developing others in the near future with countries interested in cooperate with Spain. **Scope:** Cooperation in R&D. **Connection to JPI SRIA**: Environment, water technologies, clean technologies, **Estimated budget:** Funding is available at national level, a normally it is not earmarked.
India	Spain has pursued strategic collaborative alliances with India in science and technology at different levels: **INDIA - SPAIN PROGRAMME CO-OPERATION ON INDUSTRIAL R&D**

On June 12th, 2007 a Memorandum of Understanding (MoU) was signed between the Ministry of Education and Science (MEC) and the Ministry of Industry, Tourism and Trade (MITyC) of Spain, with the Ministry of Science and Technology (MST) of India. Parties committed to promote direct scientific and technological co-operation between Government agencies, universities, public research bodies, academies of science, research institutions, institutes of higher education, enterprises and scientific societies. Within this cooperative frame the Department of Science and Technology (Ministry of Science and Technology, MST India) and the Centre of the Development of Industrial Technology (CDTI, depending on MINECO) signed on January 30th 2013, a Programme of Cooperation in order to develop a joint mechanism to promote and fund innovation-driven research and technology development between S&T stakeholders of both countries as well as to encourage partnerships and business-led R&D&I projects in areas of mutual interest. On the Indian side funding and other services are provided through the Global Innovation & Technology Alliance (GITA), a not-for-profit section 25 Company, promoted by the Confederation of Indian Industry (CII) and Technology Development Board of the Department of Science & Technology. On the Spanish side, funding and other services are provided by the Centre for the Development of Industrial Technology (CDTI).

This India-Spain program aims to foster and support the development of collaborative Industrial R&D projects consisting in the joint development of innovative products, processes and services, bringing together companies, research organisations, academic institutions and other collaborators from both countries. In November 12th 2013 a joint call for funding collaborative industrial R&D projects was published with two priority thematic areas: "Information and Communications Technologies (ICT)" and "Water Technologies". In the case of Water technologies, the following subareas were included as priority topics:

- Water Resources Management
- Use and Consumption of Water
  - Collection, pumping and water transportation, distribution
  - Water Supply and Sanitation (desalination, water quality treatment technologies, treatment and purification of drinking water)
  - Water and Agriculture, efficient use of water for irrigation in agriculture
  - Water and Energy Efficiency
- Wastewater Treatment
  - Water recycling and renovation for multiple uses, Biotechnology and Nanotechnology options for water recovery and renovation.
  - New treatments (water and energy - harvest energy from the organic material while supplying clean water)

Results of the joint call are expected to be released during summer 2014.

ERA-net NEW INDIGO

MINECO participates in the project ERA-net New INDIGO, a multilateral partnership involving several European and Indian research funding organisations aimed to strategically collaborate on Science and Technology research on several priority thematic areas. The New INDIGO funding Programme officially referred to as the New INDIGO Partnership Programme supports Indian-European multilateral research and networking projects. Since its start, New INDIGO has implemented four multilateral calls of Networking Pilot Programmes (NPP) to enable scientific and innovative cooperation of excellent researchers from Europe and India. One of them specifically refers to water: NPP II:

	Networking projects in the field of Water Related Challenges. 9 projects have been funded in this Pilot Programme, with Spanish partners in all of them, focusing on these areas: i) Wastewater Management including applications to Industry and Agriculture; and ii) Green Chemistry applied to Water Purification including Drinking Water Purification. The Spanish budget: for these projects was 171 k€. **Scope:** Joint call programming for promoting science and technological innovation **Connection to JPI SRIA**: Ecosystem Sustainability, developing safe water systems, promoting competitiveness in industry, implementing water wise bio based economy, closing water cycle gap **Estimated budget: -**
Japan	**Spanish-Japanese Cooperation Program (2009-2014)** Between the Spanish State Secretariat for Research, Development and Innovation, dependent on the Ministry on Economy and Competitiveness (MINECO) and the Japanese Science and Technology Agency (JST), dependent on the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) (topic including water research). The objective of this program is to increase Spanish competitiveness on Nanotechnology and New Materials Development for different applications on the Environment, including water, which will allow a sustainable economic development. The main thematic areas include: Photovoltaic Energy, Nanomaterials for a Green and Efficient Energy, New Devices for Energy and Materials for Batteries, Hydrogen Storage and New Batteries. The program launched three competitive calls for 3-years duration projects. 17 projects for a total of 8M€ have been financed. Other collaboration activities between Japan and Spain include the bilateral meetings and seminars. MINECO also participates, along with other 9 European (7 countries) and 3 Japanese Agencies, in the ERA-net "CONCERT-Japan". This ERA-net launched a competitive call for research projects on which MINECO takes part, centered on Energy storing and distribution. A total of 4 projects were granted, 2 of which have Spanish participation. **Scope:** applied research /innovation/technological development **Connection to JPI SRIA:** Maintaining ecosystem sustainability**,** Developing safe water systems for citizens, Promoting competitiveness in water industry, Closing the water cycle gap **Estimated budget: -**
South Africa	In general, cooperation between Africa and EU in the field of science, technology and innovation has strengthened in recent years. In this framework, the following partnership actions between Spain and South Africa were identified. **ERA-NET ERAfrica**

	In this ERA-NET (European Research Area Network for Africa - Developing African-European joint collaboration for Science and Technology) Spain participates through the Ministry on Economy and Competitiveness (MINECO). The South African partner is the Department of Science and Technology (DST) of South Africa. It facilitates the networking of European and African research donors and encourages joint calls for proposals to promote long-term cooperation between EU Member States and /or associated countries and African countries. ERAfrica provided the opportunity, for the first time, for countries from the two continents to define jointly the priorities and fields in which they decide to collectively invest. All parties participate in the decision-making on an equal basis, irrespective of the amount of their financial contribution. The first joint call for proposals was made in January 2013. This finances three types of cooperative activities: research, innovation and capacity building. Water was not a priority for this call, although water issues could be related to the following Call priorities: • Renewable energies, • Interfacing challenges (challenges of common interest) and • New ideas **South Africa & Spain Innovating Program (SASI) for Technological Cooperation** The South Africa & Spain Bilateral Technology Cooperation Program promotes joint technology cooperation projects between private companies from South Africa and Spain via technology transfer, industrial research, technological development and innovation. The objective of this program is to promote, assist and fund the development of joint technology cooperation from South Africa and Spain in areas of mutual interest for the purpose of generating economic benefits for both countries, principally in energy and infrastructures that may be linked to any water issue. Each country, through its managing entities, CDTI in Spain and TIA in South Africa, is responsible for evaluating and later certifying the projects approved with a "seal of quality" that offers to participating companies: • Added value associated with international cooperation and acknowledgment of the participants' technological level. • It makes it easier for the companies to get financial aid in each country, in accordance with their own rules and without exchanging funds. **Scope:** Research and innovation projects **Connection to JPI SRIA:** developing safe water systems for the citizens **Estimated budget p/y:** - **A MoU on Cooperation in the field of Water Resources between the Ministry of Water and Environmental Affairs of South Africa and the Ministry of Environmental, Rural and Marine Affairs of Spain** will be signed during the second quarter of 2014. In accordance with the objective of this MOU, the two signatories shall cooperate in the

	following areas: • Water related strategies, policies and planning; • River basin water resources management. Draught and flood management; • No conventional resources: Reuse and desalinization; • Water-saving irrigation; • Dams construction, management, and operation; • Impacts of climate change on water resources and countermeasures; • Monitoring of water resources: Hydrological information systems. • Water treatment technologies (waste water and drinking water, etc) • Coordination and collaboration in international water events; • Capacity building for managerial and technical staff on the above areas; • Cooperation on other areas that are of mutual interest. Referring to the objectives of this MOU, the areas of cooperation may take the following forms: • Facilitating high level visits, as well as technical and scientific exchanges; • Exchanging information and literature related to the fields specified in the second heading of this Arrangement, as well as sharing knowledge and experiences and exchanging experts and training groups; • Jointly organizing workshops, meetings, seminars, training programmes and study courses on themes of common interests; • Encouraging the cooperation and exchanges between river basin authorities, water related research institutions and enterprises of the two signatories; • Establishing an expert network between the two countries; • Promoting vocational training and internships in water institutions in both countries; • Promoting and developing cooperative projects of mutual interest; • Other forms of cooperation to be determined by the two signatories after negotiation.

5.4. UK, Strategic priority countries

India	The **UK Natural Environment Research Council (NERC)** has MoU with the Ministry of Earth Sciences which sets out plans to deliver cutting-edge science through close collaboration and two-way knowledge exchange involving leading researchers from both countries. The core objective is to improve understanding of how the global water cycle is changing and the impacts this could have (e.g. in terms of flood and drought). This covers joint funding of Indian and UK researchers within the Changing Water Cycle Research Programme, which is exploring the likely decadal changes in component of the water cycle. Five joint consortia have been funded to carry out field and modelling work in S. Asia, starting in 2013. Funding contribution from the UK is approximately 3 M€ . This involves the British Geological Survey and several UK universities including Durham, Imperial College, Dundee, Oxford, Reading, Exeter, Cranfield and others. Research is the fastest growing element of the bilateral relationship between the two countries, with jointly funded collaborative research developed between UK Research Councils and their Indian counterparts growing from £1 m to around £150 m in five years. Currently agreed priorities include water supply and security. The research collaborations are often closely linked with UK and Indian industry partners, with more than 90 partners involved in the research (http://www.rcuk.ac.uk/india). **Scope:** Collaboration is in both basic and applied research/mobility **Connection to Water JPI SRIA**: Maintaining Ecosystem Sustainability / developing safe water systems / promoting competitiveness in industry/closing water cycle gap **Estimated budget per year:** >5 M€
China	Collaboration in research and development with China has been given high priority by the UK government, of which water is seen to be an area for potential growth. The UK China science and innovation relationship is being built up through collaborative cofunded UK-China joint programmes, investments from the UK's innovation agency the Technology Strategy Board, Research Councils UK (RCUK), the Chinese Ministry of Science and Technology, RCUK, the Chinese Academy of Science (CAS) and the National Natural Science Foundation of China (NSFC). The Foreign and Commonwealth Office Science and Innovation Network and Research Councils UK have office bases in China and new initiatives are being encouraged. This includes: • Work in water management infrastructures, • Urban and agricultural areas. The water management of large river basins and the observation and modelling of megacities is currently of interest. Between 2008 and 2010, RCUK China supported a range of activities to promote UK-China research collaborations including 40 Summer Schools and 30 UK-China workshops. We have developed a significant multi-million pound programme of joint funding activities with key research funders. There are also ambitious plans for future

	collaborations. These include water availability, food and soil security. Since opening offices five years ago, joint research funding of £57m in China has been allocated. In December 2013, science agreements, including a joint £200 million fund for research and innovation have been initiated. NERC research institutes and universities are also active in facilitating exchange visits between UK and China researchers and operational managers across the water industry. Several UK universities have dedicated UK/ China partnership centers, eg. Surrey and Lancaster. This is exampled by CEH and the James Hutton Institute who are collaborating with CAS and its **Research Center for Eco-Environmental Sciences (RCEES)** to target research on the: • Remediation and recovery of polluted environments, • Water and food security and watershed management, • Soil contamination, and • Development of eco-toxicology tools for environmental monitoring. **Scope:** most of collaboration is **applied research / mobility / consultancy** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap **Estimated budget per year:** > 5 M€
USA	Reinforcing the strength of the transatlantic relationship is viewed as very important part of the UK Strategy for International Engagement in R&D. Most of the UK Research Councils fund fellowships, networking and workshops with US research bodies. **NSF with UK NERC are founding members of the Belmont Forum**, an international alliance of research funders, which has initiated calls on freshwater security and coastal vulnerability. This has led to a number of joint collaborative projects. A further call on e-infrastructures is in development. **NSF** is also working with the UK Engineering and Physical Sciences Research Council in a **"Clean Water for all"** call, encouraging collaborations between academic groups in the UK and the USA in the area of Water Engineering. EPSRC is putting £1-2 million into this call. The RCUK US office aims to facilitate further collaboration between US and UK researchers, including the movement of researchers between the US and UK and access to facilities, data and resources; and to work with US research organizations in influencing the international research agenda and promote the excellence of the UK research base. Key opportunities include: • Water quality (purification and wastewater treatment), • Water resource management, and

	• Water infrastructure. The RCUK Office is situated in the British Embassy in Washington DC and is co-located alongside the UK's Foreign and Commonwealth Office's (FCO) Science and Innovation Network (SIN) team. The RCUK Office works closely with the FCO SIN, including Consulate-based teams, others such as UK Trade and Investment and the British Council. Formal and informal collaborations in water research also take place with USGS, US Corps of Engineers, EPA, USDA (sometimes through third party international bodies such as UNESCO, IGBP, WMO) and other bodies at individual State levels. **Scope: basic and applied research /mobility/consultancy** **Connection to Water JPI SRIA:** Ecosystem Sustainability/ developing safe water systems, promoting competitiveness in industry, closing water cycle gap, implementing water wise bio based economy. **Estimated budget per year:** >5 M€

5.5. The Netherlands, Strategic priority countries

India	The Dutch Ministry of economic Affairs has a MoU with the Indian Department of Science & Technology called **DIWALI** (Dutch Indian Water Alliance). DIWALI strives for a virtual institute for research on various water issues and collaboration on innovation. For the innovation part Netherlands and India did not choose for joint calls but a tailor made approach using existing funding schemes. DIWALI was signed in 2013 and a first collaboration project between Dutch and Indian enterprises will start in February. Utrecht University has a strategic partnership with the Indian TERI institute and a local TERI office in Utrecht. Other universities like Delft University, Unesco IHE, Wageningen University (WUR) have student exchange programmes or / and mobility of researchers or take part in EU funded projects like High Noon (http://www.eu-highnoon.org) and the Saph Pani project http://www.saphpani.eu/ The Dutch Ministry of Infrastructure and Environment signed in 2013 a MoU on Urban Development. Water management is one of the priority areas of this MoU. From a business point of view the Dutch water industry selected India as a priority country. **Scope:** most of collaboration is **applied research / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap **Estimated budget per year:** < 1 M€
China	The Dutch research funding agency **NWO** has a strategic programme (JSTP) with the **National Natural Science Foundation** in China. In 2009 a joint call was launched on Integrated water management in relation to climate change and seal level rise. The budget for this call from the Netherlands was 3 M€. In this call 7 proposals were submitted. The JSTP programme is a partnership between the Dutch organisations NWO, KNAW, Ministry of Education, Culture and Science and the Chinese CASS, CAS and MoST. Delft University, UNESCO IHE, Wageningen University and Utrecht University have strategic partnerships in China and active in mobility of researchers. Wageningen University has an office in Beijing and Delft University has a water institute in Nanjing and an institute on Urban Systems & Environment in Guangshou. Also Utrecht University has different partnerships with Chinese institutes. From a business point of view the Dutch water industry selected China as a priority country.

	Scope: most of collaboration is **applied research / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap **Estimated budget per year:** < 1 M€
Brazil	Cooperation with Brazil is increasing and it is expected that water will be a priority in the near future. From a business point of view the Dutch water industry selected China as a priority country. **Scope:** most of collaboration is **applied research /mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap, implementing water wise bio based economy **Estimated budget per year:** < 1 M€
South Africa	Delft University, WUR and UNESCO IHE have partnerships with South African and RDI projects were funded by NWO. Vitens – Evides International has launched in 2013 the Center of Expertise with the aim to set up pilots for safe and clean drinking water. **Scope:** most of collaboration is **applied research / innovation / mobility/capacity building** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap **Estimated budget per year:** < 1 M€
Vietnam, Bangladesh, **Egypt, Mozambique**	As the Netherlands is a delta region with specific challenges the Dutch government selected 4 Delta countries in the world for knowledge exchange in the field of coastal zone management, flooding and IWRM. **Scope:** most of collaboration is **applied research / innovation / piloting / implementation** **Connection to Water JPI SRIA:** eco systems **Estimated budget per year:** -

5.6. Turkey, Strategic priority countries

Morocco	The Turkish Ministry of Forestry and Water Affairs has a MoU with the Moroccan Department of Science & Technology on water and environment issues. The MoU, which has been valid since 2004, does not include any particular statement on water RDI. The MoU has rather general provisions for capacity building and training activities for the Moroccan experts. Morocco has potential for implementing RDI projects. Morocco has been looking for unconventional water collection methods including desalination at high rate. Also there is a growing need for healthier water distribution systems. **Scope:** most of collaboration is **capacity building / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry **Estimated budget per year:** < 1 M€
Turk-menistan	The Turkish Government has signed a bilateral agreement with Turkmenistan on water related issues. According to the agreement: The collaboration is mostly on capacity building level on environmental issues, such as forestry and erosion control. RDI programs have not been developed between two countries so far. Nevertheless, water in Turkmenistan is a dramatic topic regarding the rapidly decreasing water sources. There may be a need for advanced RDI studies on water saving in irrigation. Turkey is continuously increasing its technical cooperation on water issues in EECCA region and Turkmenistan is within this group. **Scope:** most of collaboration is **capacity building / mobility** **Connection to Water JPI SRIA:** developing safe water systems **Estimated budget per year:** < 1 M€
Azer-baijan	SUEN recently cooperates with Azerbaijan, yet at the level of capacity building on water and wastewater characterization, treatment and infrastructure. We welcome engineers from two countries to give them theoretical and on field training courses. SUEN is in the planning stage for realizing RDI activities on novel water treatment technologies with Azerbaijan. **Scope:** most of collaboration is **capacity building / mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry **Estimated budget per year:** < 1 M€

South Korea	National Research Center on Membrane Technologies **(MEM-TEK)** has been a partner to the **KORANET** Joint Call on 'Green Technologies' since 2012. The other partner of the project is University of Applied Sciences (Berlin). The joint project "Quorum Quenching Energy Saving Technology in Membrane Bioreactor for Wastewater Reuse to cope with global water scarcity". The overall aim of the project is to develop an energy saving MBR process for waste water reuse based on bacterial quorum quenching. It is a two year project (10/2012-09/2014) that costs 150 k€. **Scope:** This singular project is related to **applied research and innovation** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry **Estimated budget per year:** < 1 M€

5.7. Cyprus, Strategic priority countries

Israel	The Cyprus Government has signed a bilateral agreement with Israel. The Research Promotion Foundation is preparing at the moment a bilateral Call for Proposals with the Office of the Chief Scientist of the Ministry of Industry, Trade and Labour of Israel. Further collaboration can be done through ERA-NET or other instruments. Furthermore, national calls by the Research Promotion Foundation allow participation of foreign partners from countries outside the EU with funding up to 30% of the project budget. **Scope:** most of collaboration is **applied research or innovation / networking** **Connection to Water JPI SRIA:** proposals can include water related topics. **Estimated budget per year:** < 1 M€
USA	Cyprus has signed a Cooperation Agreement with the USA. The national funding action "Targeted International Cooperation" aims at the networking of Cypriot organizations with research centers of excellence from the specific countries of cooperation, including USA. Collaboration can be done through ERA-NET or other instruments. Furthermore, national calls by the Research Promotion Foundation allow participation of foreign partners from countries outside the EU with funding up to 30% of the project budget. **Scope:** most of collaboration is **applied research or innovation / networking** **Connection to Water JPI SRIA:** proposals can include water related topics.
Canada	Collaboration can be done through ERA-NET or other instruments. The national funding action "Targeted International Cooperation" aims at the networking of Cypriot organizations with research centers of excellence from the specific countries of cooperation, including Canada. Furthermore, national calls by the Research Promotion Foundation allow participation of foreign partners from countries outside the EU with funding up to 30% of the project budget. **Scope:** most of collaboration is **applied research /mobility** **Connection to Water JPI SRIA:** proposals can include water related topics.
India	Collaboration can be done through ERA-NET or other instruments. The national funding action "Targeted International Cooperation" aims at the networking of Cypriot organizations with research centers of excellence from the specific countries of cooperation, including India. Furthermore, national calls by the Research Promotion Foundation allow participation of foreign partners from countries outside the EU with funding up to 30% of the project budget. **Scope:** most of collaboration is **applied research / innovation / mobility** **Connection to Water JPI SRIA:** proposals can include water related topics.

Egypt	Cyprus has signed a Cooperation Agreement with Egypt. In the past the Research Promotion Foundation has announced Call for Proposals in collaboration with the Academy for Scientific Research & Technology of Egypt. At the moment, collaboration can be done through ERA-NET or other instruments. Furthermore, national calls by the Research Promotion Foundation allow participation of foreign partners from countries outside the EU with funding up to 30% of the project budget. **Scope:** most of collaboration is **applied research or innovation / networking** **Connection to Water JPI SRIA:** proposals can include water related topics.

5.8. Finland, Strategic priority countries

India	The Academy of Finland (AKA) has agreements on cooperation with three Indian research funding organisations: the Department of Biotechnology (DBT), the Department of Science and Technology (DST) and Tooltech Ltd. The cooperation is designed to support researcher mobility and joint projects. Joint calls have been carried out in 2006–2013. The theme of each call is defined separately. The Academy is also developing cooperation with other Indian organisations engaged in research, such as the Indian Council of Medical Research (ICMR) and the Council of Scientific and Industrial Research (CSIR). The call for the New INDIGO ERA-NET opened in 2013 with India's DST among other countries. The call theme is energy research, which is further divided into Smart Energy Grids and New Energy Materials. The Finnish Funding Agency for Innovation (TEKES) collaborates through Water Research Program with innovation projects. **Scope:** most of collaboration is **basic research / applied research / innovation / mobility** **Connection to Water JPI SRIA:** Maintaining Ecosystem Sustainability (?) **Estimated budget p/y:** several k€
China (and Taiwan)	The Academy of Finland has agreements on cooperation with the Chinese Academy of Sciences (CAS) and the National Natural Science Foundation of China (NSFC) covering all scientific disciplines, except for those that belong to the domain of the Chinese Academy of Social Sciences (CASS). The Academy also has an agreement on cooperation with the National Science Council of Taiwan (NSC). TEKES collaboration has been done through Water Research Program with applied research projects: Finnish Environmental Cluster for China, funding from Ministry of Employment and the Economy **Scope:** most of collaboration is **basic research / applied research / mobility** **Connection to Water JPI SRIA:** Maintaining Ecosystem Sustainability **Estimated budget per year:** several k€
Japan	The Academy of Finland has agreements on funding cooperation with two Japanese research funding organisations: the Japan Society for the Promotion of Science (JSPS) and Japan Science and Technology Agency (JST). Cooperation with the JSPS covers all scientific fields. The cooperation is designed to support joint projects in addition to researcher mobility and seminars. Besides the Academy, the cooperation with the JST also involves TEKES, and the joint calls are arranged trilaterally in jointly agreed fields. The Academy also has active contacts with the Finnish Institute in Japan, the FinNode Innovation Center in Tokyo, and the National Institute of Science and Technology

	Policy (NISTEP). **Scope:** most of collaboration is **basic research / mobility** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** several k€
USA	**Academy of Finland;** Collaboration with National Science Foundation (NSF) TEKES collaboration has been done through Water Research Program with innovation projects: Cleantech US-Tour – Discover Finn-Tech, FinnFest 2011 event at USA. **Scope:** most of collaboration is **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget p/y:** several k€
Canada	Research funding cooperation is carried out within the Academy of Finland's research programmes in Health. TEKES collaboration has been done through Water Research Program with innovation projects: 2011 innovation mapping which led to collaboration between TEKES and Alberta Innovates Technology Futures (AITF), also Alberta-Finland Technology Innovation and Commercialization program, call on water management. **Scope:** most of collaboration is **basic research / innovation** **Connection to Water JPI SRIA:** Maintaining Ecosystem Sustainability; **Estimated budget per year:** several k€
Russia	The Academy of Finland (AKA) engages in close cooperation with three Russian science and research funding organisations, especially: • Russian Academy of Sciences, RAS (as of 1993) • Russian Foundation for Basic Research, RFBR (as of 2000) Cooperation with the Russian Academy of Sciences is intended to support the mobility of Finnish and Russian researchers. Annually a total of 200-300 research visits are made with the grants. The Academy of Finland has participated in ERA.Net RUS programme (2009–2012) funded under the EU Seventh Framework Programme for Research. ERA.Net RUS aimed at strengthening and intensifying the S&T cooperation between Russia and the European Research Area (ERA). The Calls include collaborative S&T projects on environmental research and ecosystem functions.

	TEKES collaboration has been done through Water Research Program with innovation projects: networking by Finpro: Cleantech Finland for Russia. **Scope:** most of collaboration **basic research / innovation / mobility** **Connection to Water JPI SRIA:** Maintaining Ecosystem Sustainability **Estimated budget per year:** several k€
Other countries:	Aalto University has a MoU with the Southern Institute of **Vietnam** for Water Resources Planning, close collaboration during several years. Tampere University of Technology has a MoU with **South Africa, Sri Lanka** and **Indonesia** via research group CADWES and UNESCO chair. Tampere University of Technology has also a MoU with **Ethiopia** via research group CADWES and with **Namibia, Tanzania,** and **Kenya** via UNESCO chair. Finnish Environment Institute has MoU with **Kazakhstan**. Active collaboration will likely lead to e.g. building up flood warning systems. **Scope:** most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** Unknown
Vietnam	Aalto University has a MoU with the Southern Institute of **Vietnam** for Water Resources Planning, close collaboration during several years. **Scope:** most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** Maintaining Ecosystem Sustainability (?) **Estimated budget per year:** Unknown
South Africa	Tampere University of Technology has a MoU with South Africa via research group CADWES and UNESCO chair. **Scope:** most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** Unknown
Sri Lanka	Tampere University of Technology has MoU with Sri Lanka via research group CADWES and UNESCO chair. **Scope:** most of collaboration **basic research / innovation**

	Connection to Water JPI SRIA: ? **Estimated budget per year:** Unknown
Indonesia	Tampere University of Technology has MoU with **Indonesia** via research group CADWES and UNESCO chair. **Scope:** most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** Unknown
Kazakhstan	Finnish Environment Institute has MoU with **Kazakhstan**. Active collaboration will likely lead to e.g. building up flood warning systems. **Scope:** most of collaboration **applied research** **Connection to Water JPI SRIA:** Developing safe water systems for the citizens **Estimated budget per year:** Unknown
Ethiopia	Tampere University of Technology has MoU with **Ethiopia** via research group CADWES. **Scope:** most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** Unknown
Namibia	Tampere University of Technology has MoU with **Namibia** via UNESCO chair. **Scope:** most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** Unknown
Tanzania	Tampere University of Technology has MoU with **Tanzania** via UNESCO chair. **Scope:** most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** Unknown
Kenya	Tampere University of Technology has MoU with **Kenya** via UNESCO chair.

	Scope: most of collaboration **basic research / innovation** **Connection to Water JPI SRIA:** ? **Estimated budget per year:** Unknown

5.9. Germany, Strategic priority countries

(Reference period: 2010-2013) budget only refers to German funding	
Vietnam	For the German Federal Ministry of Research and Education (BMBF) the key areas of the German-Vietnamese research cooperation include the field of hydro- and environmental technology. The BMBF and the Ministry of Science and Technology of Vietnam (MoST) jointly run an Office for Research Cooperation on Water and Sustainability in Hanoi. It supports both ministries in implementing projects for research and development related to sustainable production, notably: • Water usage, • Technical environment, and • Rational use of natural resources. At present there are about six big joint water research projects running within two BMBF Funding Initiatives: • "Integrated Water Resources Management (IWRM)" and • "International Partnerships for Sustainable Technologies and Services for Climate Protection and the Environment (CLIENT)". A mobility program with Vietnam is organised via the German Academic Exchange Service (DAAD). In this context Vietnamese students can either complete a Master's degree or a PhD in the water sector in Germany. In addition Serial Summer Schools are executed to allow Vietnamese students or experts to ally with German companies and receive information on the German water sector. There is a close cooperation between German and Vietnamese universities e.g. a joint Master Programme between Cologne University of Applied Sciences and Vietnam Academy for Water Resources. **Scope:** collaboration is **applied research, mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap. **Estimated budget** (proportionately from 2010-2013): 25 M€
China	The German-Chinese cooperation in research and science focuses also on environmental technology and ecology. There are a couple of big joint water research projects in the BMBF Funding Initiative currently running: • "Integrated Water Resources Management (IWRM)", and • "International Partnerships for Sustainable Technologies and Services for

	Climate Protection and the Environment (CLIENT)". As part of the framework program "Research for Sustainable Development" (FONA) a joint research and innovation program "Clean Water" is executed between the BMBF and the Chinese Ministry for Science and Technology. The R&D Projects are mainly financed through the BMBF funding initiative CLIENT. Several German universities have a close cooperation to Chinese universities and research institutions. **Scope:** collaboration is **applied research, mobility** **Connection to Water JPI SRIA:** developing safe water systems, promoting competitiveness in industry, closing water cycle gap **Estimated budget** (proportionately from 2010-2013): 15 M€
Jordan	The BMBF supports applied research in terms of water supply and management.. There is a big joint research project of the BMBF Funding Initiative "Integrated Water Resources Management (IWRM)". It has been running for about 8 years now. A mobility program with Jordan is organised via the German Academic Exchange Service (DAAD). In this context Jordanian students can either complete a Master's degree or a PhD in the water sector in Germany. In addition Serial Summer Schools are executed to allow for allying with German companies and the information exchange with the German water sector. **Scope:** collaboration is **applied research, mobility** **Connection to Water JPI SRIA:** maintaining ecosystem sustainability, developing safe water systems, promoting competitiveness in industry, closing water cycle gap, **Estimated budget** (proportionately from 2010-2013): 14-15 M€
Israel	The BMBF and the Ministry of Science, Technology and Space (MOST) in Israel coordinate the inter-ministerial Scientific and Technological Cooperation between the two countries. Already more than 40 years the research cooperation has been running. It concentrates on environmental research and water technology. Science is executed in the form of joint bilateral projects within the framework of BMBF programs. **Scope:** collaboration is **applied research, mobility** **Connection to Water JPI SRIA:** maintaining ecosystem sustainability, developing safe water systems, promoting competitiveness in industry, closing water cycle gap **Estimated budget per year:** 2 M€

Namibia	In the framework of the BMBF Funding Initiative "Integrated Water Resources Management (IWRM)" a joint research project is executed in Namibia. **Scope:** collaboration is **applied research** **Connection to Water JPI SRIA:** maintaining ecosystem sustainability, developing safe water systems, promoting competitiveness in industry, closing water cycle gap **Estimated budget** (proportionately from 2010-2013): 9 M€

5.10. Portugal, Strategic priority countries

General note	*Fundação para a Ciência e a Tecnologia* (FCT) is the national funding agency for science, technology and innovation, in all scientific domains, under responsibility of the Ministry for Education and Science. FCT's mission is to continuously promote the advancement of knowledge in science and technology in Portugal, attain the highest international standards in quality and competitiveness, in all scientific and technological domains, and encourage its dissemination and active role in society and in economic growth. FCT pursues its mission by funding fellowships, studentships and research contracts for scientists, research projects, internationally competitive research centers and state-of-the-art infrastructures, via competitive calls with international peer-review. FCT ensures Portugal's participation in international scientific organizations fosters the participation of the scientific community in international projects and promotes knowledge transfer between R&D centers and industry. Working closely with international organizations, FCT coordinates public policy for the Information and Knowledge Society in Portugal and ensures the development of national scientific computing resources. The results of FCT accomplishments are, in essence, the outcome of the work carried out by the individual scientists, research groups and institutions that are funded by FCT. In which regards Portugal strategies and activities outside Europe, FCT coordinates international partnerships with American universities, secures the participation of Portuguese scientists in international research programmes, via bilateral and multilateral agreements, as well as the national contributions to international organizations (such as CERN, ESA, ESO and EMBO) - an investment of around €44 million/year (2011-2013 average). Although Portugal does not have strategic priorities for Water RDI, most of the bilateral and multilateral agreements, ERA-NETs and INCO-NETs in which has been or is currently involved address themes that directly or indirectly include water related topics.
Latin America	Collaboration between Portugal and **Brazil**, a member of the Community of Portuguese Language Countries or Community of Portuguese-Speaking Countries (CPLP), is long rooted. The cooperation agreement between FCT and the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), signed in 1981, includes a Program for Scientific and Technological Cooperation supports research projects in the areas of Biotechnology, Marine Sciences, Space Sciences and Agro-Food Sciences. FCT and the Fundação Coordenação de Aperfeiçoamento do Pessoal de Nível Superior (CAPES), under the Cooperation Agreement signed between the two institutions in 1991, support joint activities of research teams from Portugal and

	Brazil that result in the qualification and advanced training of human resources in science and technology, at graduate and post graduate levels. All areas of knowledge are considered eligible, provided that particular merit is shown. Preference is given to areas associated with engineering in general, including bioengineering and biotechnology, applied physics and mathematics, computer sciences and social sciences. In 2013 a Memorandum of Understanding was signed between FCT and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) to promote the collaboration in science, technology and innovation in areas of mutual interest and facilitate the interaction between the scientific communities of Portugal and Brazil. A Cooperation Programme in Science & Technology has also been signed between **Argentina** and Portugal in 2001 (renewed through a Memorandum of Understanding in 2013) to promote bilateral cooperation between the two countries through the exchange of researchers/scientists and joint R&D projects. Key fields for R&D projects are Nanotechnologies, Renewable Energies and Marine Sciences. Needs also to be highlighted the participation of FCT in the ERA-NET project **EULANEST** (European-Latin American Network for Science and Technology). This project intended to promote and co-ordinate research co-operation among EU Member States (MS) and Latin American countries (LAC). The 2009 Joint Call addressed the thematic areas of Sustainable Renewable Energy in the frame of climate change and Nanoscience with focus on human health and involved Argentina and Brazil as funding partners. **Scope:** collaboration is Science, Technology and Innovation **Connection to Water JPI SRIA:** - **Estimated budget per year:** -
China	In 1993 Portugal and China signed a Basic Agreement of Scientific and Technological Cooperation, followed by a Memorandum of Understanding that same year, to improve cooperation in science, technology and innovation between the two countries. The Programme of Cooperation in Science and Technology facilitates bilateral cooperation between scientists/researches of the two countries by way of exploratory visits and joint R&D projects. Cooperation started with, but no exclusively, in areas of common interest like ICT, low carbon and energy technologies (renewable energy, clean energy and energy efficiency), nanotechnology and materials and biotechnology (including biomedicine, agriculture, forestry and aquiculture). **Scope:** collaboration is **applied research, mobility** **Connection to Water JPI SRIA:** - **Estimated budget per year:** -

India	The Indo-Portuguese Program of Cooperation in Science and Technology, signed in 1998, facilitates bilateral cooperation between scientists/researches of the two countries by way of exploratory visits, joint R&D projects, and joint seminars/workshops. Financial support is available in the following areas of cooperation: Ocean Science & Technology; Molecular and Cellular Biology; Biotechnology; Materials Science including Nano Technology; Health Sciences; Agricultural Sciences; Chemical Sciences; Engineering Sciences; Information and Communication Technology; Energy, Ecology, Environment. FCT also participated in the ERA-NET **New INDIGO**, a partnership of 15 funding research and technology development agencies, coordinated by the Centre National de la Recherche Scientifique (CNRS, France) and co-coordinated by the Council of Scientific & Industrial Research (CSIR, India) and aimed to strategically collaborate in science and technology research on several priority thematic areas. Although FCT has not participated in the NPP II: Networking projects in the field of Water Related Challenges was involved in the other three joint calls launched by this ERA-NET in the fields of Biotechnology and Energy research. FTC will continue its collaboration with India through the **INNO INDIGO** scheme. **Scope:** collaboration is Science, Technology and Innovation **Connection to Water JPI SRIA:** - **Estimated budget per year:** -
Africa	Cooperation between Portugal and the Community of Portuguese Language Countries or Community of Portuguese-Speaking Countries (CPLP) is considered a national strategy. To foster cooperation in S&T in all scientific domains, Portugal has signed several bilateral agreements with most of its African member states: - **Angola** (Intergovernmental Agreement in S&T, 2006); - **Cape Verde** (Intergovernmental Agreement in S&T and Higher Education, 2003; Intergovernmental Agreement in S&T, 2012); - **Guinea-Bissau** (Intergovernmental Agreement in S&T and Higher Education, 2004); - **Mozambique** (Intergovernmental Agreement in S&T and Higher Education, 2004; Intergovernmental Agreement in S&T, 2010); - **São Tomé and Príncipe** (Intergovernmental Agreement in S&T and Higher Education, 2004). The **Global Science Programme** is a Portuguese initiative for the creation of a UNESCO center for the sciences in the CPLP framework. Under this Programme, research grants have been awarded for PhD and post-doctoral researchers from Angola, Cape Verde, Guinea-Bissau, Mozambique and São Tomé and Principe to conduct research programs in Portuguese universities and other scientific institutions in association with educational, research or development institutions of the countries mentioned.

	Portugal also participates or participated in several ERA-NETs and INCO-NETs that directly involve cooperation with African countries: - **CAAST-NET** and **CAAST-NET Plus** – This Network for the Coordination and Advancement of Sub-Saharan Africa-EU Science & Technology Cooperation involves the participation of South Africa, Botswana, Senegal, Rwanda, Kenya, Madagascar, Cameroon, Nigeria, Ghana and Uganda. It encourages more and better bi-regional STI cooperation for enhanced outcomes around topics of mutual interest, and particularly in relation to the global societal challenges of climate change, food security and health. - **ERA-NET ERAfrica** – This ERA-NET (Developing African-European joint collaboration for Science and Technology) aims at facilitating the networking of European and African research donors and encourages joint calls for proposals to promote long-term cooperation between EU Member States and/or associated countries and African countries (Burkina Faso, Ivory Coast, Egypt, Kenya, South Africa). Although Water was not a priority in the first joint call for proposals in 2013, related issues were addressed: renewable energies, interfacing challenges and new ideas. **Scope:** collaboration is Science, Technology and Innovation **Connection to Water JPI SRIA:** - **Estimated budget per year:** -
Mediterranean region	Regional International Cooperation must take into account the national priorities of the targeted countries and their shared interest by the EU. Following this goal, Portugal participated or currently participates in INCO-NETs directed to regions with whom shares common interests: - **MIRA** relied with the participation of Morocco, Tunisia, Egypt, Algeria, Lebanon, Jordan, Israel, Palestine, Malta and Turkey and addressed water related issues as water resource management, desalination, desertification, energy and decontamination of the Mediterranean. - The Mediterranean Science, Policy, Research & Innovation Gateway - **MED-SPRING** project - is a coordination and support action that builds on the previous experience of the INCO-NET MIRA, but adapted to the new reality of the Euro-Mediterranean policy and the general orientations defined in the Euro-Mediterranean Conference of Barcelona (2-3 April 2012), is focused on three societal challenges (Energy, High Quality Affordable Food, and Scarcity of resources) Within the Mediterranean countries, we also highlight the agreements between FCT and the Centre National pour la Recherche Scientifique et Technique (CNRST, **Morocco**) and between the Ministère de l'Enseignement Supérieur, de la Recherche Scientifique et de la Technologie (**Tunisia**), that specifically support the exchange of researchers within common joint research projects.

	The bilateral agreement with Morocco, signed in 1999, contemplates several scientific domains, including Agricultural Sciences, Environmental Sciences, Earth Sciences, Biology, Biotechnology and Chemistry. The bilateral agreement with Tunisia signed in 1995 and renewed in 2010, focus among others in Water and the Environment, Renewable Energies, Biotechnology and Food Engineering and Health Sciences. **Scope:** collaboration is Science, Technology and Innovation **Connection to Water JPI SRIA:** - **Estimated budget per year:** -
USA	Collaborations with Morocco in Water RDI projects funded through national/transnational calls stand among other non-European countries involved, albeit its small significance in terms of number of projects. **Scope:** collaboration is Science, Technology and Innovation **Connection to Water JPI SRIA:** - **Estimated budget per year:** -

5.11. Inputs from other Water JPI partners

JPI member	Priority countries outside Europe	Remark
Ireland	India, USA, China, Qatar, Brazil	No specific actions planned
Romania	China, Moldavia	
Norway	China, India	China agreement on joint call with CAS: Three running projects on fresh water pollution.
		India agreement on joint call with DST. Two joint IN-NO research projects on melt back of glaciers in the Himalayas
Denmark	India, Vietnam, Tanzania, Zambia, Ghana, Bolivia	**India** in particular for Danish private sector. Collaboration outside Europe is in particular related to the policy of the Ministry of Foreign Affairs of Denmark. **Vietnam:** ENRECA programme on Capacity Building, bilateral research project **Tanzania:** ENRECA programme on Capacity Building **Zambia:** Water Sector programme, bilateral research project **Ghana:** ENRECA programme on Capacity Building **Bolivia:** research project
Italy	Brazil, Australia, India, Morocco, Lebanon	Italy has bilateral programmes with these countries on basic research, applied research and innovation. Furthermore Italy plays an active role in supporting an adequate and sustainable development of water resources outside Europe by implementing several projects to build up key infrastructures, streamline water consumption and improve water supply and sanitation services, especially in the Middle East region, in the Sub-Saharan Africa and in Vietnam. A close cooperation also exists with Albania. For water RDI in particular the **Mediterranean region** is of

		strategic importance for Italy. Following are several of the principal water initiatives undertaken by the DG Development Cooperation of the Italian Ministry for Foreign Affairs in recent years. Many projects funded by Italy are ongoing to support the water sector especially from the policy and administrative point of view: • To provide technical assistance in the sustainable and integrated water management, and, • To build aqueducts, sewage systems or hydroelectric power plants. The main beneficiary countries are: Jordan, Egypt, Kenya, Lebanon, Morocco, Angola, Mali, Mozambique, Sudan, Bolivia, Brazil, Honduras, Haiti, Nicaragua, Peru, Bangladesh, Tunisia, Tanzania, India, China, and Vietnam. The list of funded projects during the last 4 years includes few research projects on water issues.

Programmes on water collaboration between Ireland and Third Countries

Public Bodies / Agencies	Duration (YYYY - YYYY)	Bilateral agreements with USA	Bilateral agreements with Canada	Topic	Insight about these agreements/projects i.e., on R&D area, partners involved, type of institutions, timeframe, budgets involved (eventually), etc.
Marine Institute	1995 - On-going	US Department of Commerce / National Oceanic and Atmospheric Administration (NOAA)		Marine Science and Technology	Exchange of Information, Staff exchanges , Joint Research, Joint Symposia, Seminars and Lectures, Further joint activities as are deemed appropriate
EPA	Approx 2003 - ongoing	Fullbright Commission		General Environmental	Fellowships for young & experienced researchers,
CELTNET and SmartBay Projects (Marine Institute)	2008 - On-going		NEPTUNE (Canada), Ocean Networks Canada, University of Victoria	Ocean Observatories	Reciprocal research and educational experiences for researchers, faculty, students and employees, Uvic/SmartBay/CELTNET visiting researcher status, Staff Secondmnents, Joinr Liaison Committee
Department of Agriculture, Fisheries and Food (Marine Institute)	2010 - On-Going		Ministry of Fisheries and Aquaculture, Newfoundland and Labrador (Memorial University, Newfoundland)	Fisheries and Ecosystem Science	Co-operation between fisheries and oceanographic related survey activities, charter of the RV Celtic Explorer (Marine Institute) to Memorial University of Newfoundland
Science Foundation Ireland	Approx 2003-ongoing				Various schemes tbc
Minister for Communications, Energy and Natural Resources	2012 - On-Going	US Department of Energy		Marine and Hydrokinetic Energy Technologies	Marine and hydrokinetic Resource Assessment Methodology, Exchange of Personnel for short-term visits and assignments, test Planning and Evaluation of Marine and Hydrokinetic Energy Technology Demonstration Projects, Exchange of Engineering and Environmental Test Data, Exchange of Information on Marine and Hydrokinetic Energy Device Modelling, Dissemination of Information on Participant Activities
Marine Institute	2011 -	Network of Irish Scientists in the USA (The Wild Geese)			to connect with Irish scientists working in the USA

6. INTRODUCTION TO THE 7 COUNTRY REPORTS

Brazil, India, China, South Africa, United States, Canada and Vietnam

6.1 Introduction and methodology

Brazil, India, China, South Africa, United States, Canada and Vietnam were selected by the Water JPI for further survey. This selection was made based on already existing links by individual Water JPI partners and the connection with the EC (SFIC)

The country reports that were selected by the Water JPI contain the following information:

1) **General description of Water Challenges in the selected country**

Information is derived via desk research and internet on the major water challenges in the specific country.

2) **Institutional framework**

This describes the major organizations dealing with water policy and the major organisations dealing with water RDI.

3) **Water use per country and market forecast on water treatment technology**

To have a better understanding of the market drivers in the selected countries a survey is executed on the main water users per sector in the specific countries and the market forecast. This information will help to shape the strategy for WatEUr workpackage WP5 and to make a selection of countries for further collaboration. Each country survey contains a summary of the main water users per sector and an overview of expected market growth in various sectors.
More detailed information per country is given concerning trends in water use and market information. For Vietnam no market data is available yet.

Information is derived from internet sources and Global Water Market 2011 from the publishers of Global Water Intelligence. This is one of the most respected sources concerning business forecasts.

4) **Bibliometric analysis of Research and Development performance**

The Third Country Bibliometric Report is based on the **analysis of publications** (1998-2012) compiled from the Web of Science® (See Annex I for details). Publications have been identified for the **five research questions** expressed in the Water JPI Strategic Research and Innovation Agenda (SRIA):

1. Maintaining **Ecosystem** Sustainability;
2. Developing safe water systems for the **citizens**;
3. Promoting competitiveness in the water **industry**;
4. Implementing a water-wise **bio-based economy**; and
5. Closing the water cycle **gap**.

Publications are expressed as: 1) ratios per inhabitants and per GDP; and 2) as a **percentage respect** to the same ratio applied to **Europe** (Member States and Associated Countries).

The **Increase rate** of publications expresses how fast water publications are increasing in time in the third countries. This rate was calculated as: 1) absolute value: the number of publications from the three last years of the analyzed period divided by that of the three first years; and 2) relative value: the absolute Increase rate of the country divided by the same absolute value applied to Europe (Member States and Associated Countries), expressed in percentage.

The index of collaboration expresses how often researchers from third countries publish with colleagues in other countries. This index was obtained from the analysis of publications by countries. The **Index of International Collaboration** is the frequency of authors from other countries in the water publications of the target country, expressed as a percent. The **Index of European Collaboration** is the frequency of European authors (Member States and Associated Countries) in the water publications of the target country, expressed as a percent. Due to the frequent occurrence of more than foreigner author in a publication, these indexes do not reflect the percent of publications with international cooperation. As a consequence, they should mainly been used to establish comparisons among countries.

All Water publications from each country are analyzed per cooperating country (**Who is publishing with?**), per funding agency (**Who is funding this research?**), and per performing organization (**Which Institutes are doing the work?**). Finally, the publications obtained for each research question are analyzed by organization and author. The five first ranked items are displayed in all these analyses.

5) Major RDI programmes or Agency funding Water activities

Major RDI programmes or Agency funding Water activities were identified from the main funding organizations in the specific third country, covering relevant programmes and activities.

6) List of Acronyms and reference documents

7. BRAZIL

7.1 Context and RDTI[1]

Brazil is the largest country (8,500,000 km²) in Latin America. It is rich in natural resources and it currently is the World's 6th largest economy, with a promising growing domestic market. Its population reached 201 million in 2012 (85.4% of the population is living in urban areas) and its GDP is 1,645 G€.

Brazil's overall investment in S&T (GERD) in 2010 was 1.16% of GDP, a share above other major Latin American economies such as Argentina, Chile and Mexico. Brazil's government goal is to increase its GERD to 2.2% by 2022.

Brazil is the World's 13th largest producer of scientific publications, with a growing rate of 8% per year. Scientific production is strongly concentrated in Sao Paulo State, which personifies 50% of Brazil's total GERD. Innovation is still far from driving the Brazilian national economy forward. The Global Innovation Index 2012 placed Brazil 58th, comparable with China and India.

International cooperation in the form of multilateral and bilateral agreements has grown partly because of Brazil's increasing role in key global issues, such as climate change and renewable energies. As from 2011, Brazil has strengthened bilateral cooperation agreements in STI notably with Germany, France, United States, United Kingdom, Finland and Switzerland, and the European Union as a whole.

7.2 Water challenges

Brazil holds 12% of the World's fresh water. Water is very unevenly distributed across the country. Around 50% of the water is found in the Amazon, where only 4% of the Brazilian population lives, whilst 80% live less than 100 km from the Atlantic Ocean. These large disparities in terms of the availability of the resource and the distribution of the population pose real challenges, such as the issue of producing and transporting drinking water to the coast, wastewater treatment, etc. In the urban areas, access to drinking water resources is very uneven. Water scarcity is common in the Northeast of Brazil; water pollution can be frequently found in the South-East of the country. About 35% of the collected wastewater is currently treated.

Large climatic variability can be found in Brazil, where equatorial, tropical, semi-arid and sub-tropical climates can be found. Climatic diversity presents an additional challenge, with large areas subjected to floods and droughts.

The geopolitics of water is also an integral part of the major challenges facing this country. Brazil shares river basins with ten countries. This makes hydrological monitoring and pollution control more challenging, and requires international cooperation in the region.

[1] Information based on a)"Research and Innovation Co-operation between the European Union, Member States, Associated Countries and Brazil" May 2013; b) Website of the National Water Agency in Brazil http://www2.ana.gov.br/Paginas/default.aspx visited on 10 January 2014; c) The WHO-UNICEF Joint Monitoring Programme for Water Supply and Sanitation 2013 Webiste http://www.wssinfo.org/ visited on 10 January 2014 and d) ERAWATCH Platform on Research and Innovation policies and systems http://erawatch.jrc.ec.europa.eu/ visited on 20 January 2014.

In relation to water quantity, Brazil is a key global player in hydroelectricity, with more than 85% of the country electricity consumption produced by hydroelectric plants.

7.3 Institutional framework:

Research

At the Federal level the main player is the Ministry for Science, Technology and Innovation (MCTI). Through its sub-secretariat on coordination of research units it manages over 20 units of scientific, technological and innovative research. Due to their funding importance and scientific relevance, the Funding Agencies to be analysed in this report are four: the National Council for Scientific and Technological Development (CNPQ), the Agency for Support and Evaluation of Graduate Education (CAPES), the São Paulo State Research Foundation (FAPESP), Minas Gerais State Research Foundation (FAPEMIG) and The Studies and Projects Finance Organization (FINEP), followed by a brief analysis of the Water RDI related National Institutes of Science and Technology (INCT).

Water

The National Water Agency (ANA) is legally liable for implementing the National Water Resources Management System (SINGREH), created to ensure sustainable use of Brazilian rivers and lakes for the current and future generations. This implies regulating the use of water according to the mechanisms established by Law No. 9433, of 1997. ANA plays regulatory actions, supports the management and monitoring of rivers and reservoirs, and is responsible for water resources planning.

7.4 Brazil, water use and market overview

Brazil Sector	%	km³ / y
Irrigation	69	30.7
Public supply	11	4.9
Industrial	7	3.11
Rural	2	0.89
Animal	11	4.9
Total	100	44,5

São Paulo state's projected demand in 2030 of 20.2 billion m³, against a current accessible, reliable supply of 18.7 billion m³. Nearly 80% of this demand is reflected in the São Paulo macro-metropolitan region, with a projected population of 35 million in 2030. This quantity challenge is compounded by severe quality issues, as even today, low coverage of sanitation collection and treatment means that a significant proportion of São Paulo's water supply is polluted —requiring over 50% of current supply to the region to be transferred from neighboring basins.[1]

[1] Source: 2030 Water Resources Group

Brazil is increasingly investing in the expansion of water supply and sanitation coverage, based on the 2007 Sanitation law no. 11445, which aims for the universalization of access. Investments of around BRL 11 billion should be available for 2011 from federal resources. BNDES estimates that investments for the period of 2009 to 2012 were around BRL 37 – 40 billion. Moreover, in mid 2010, the government launched the second version of the Programme for Acceleration Growth (PAC 2), which will focus on basic infrastructure and expansion of water supply.

Nevertheless, to cope with these objectives, there will be a likely increase in external investments and private sector participation. According to the Brazilian Association of Public Water and Sanitation Utilities (Abcon) it is expected that private sector participation in Brazil's water sector will increase from 6.5% of urban population to 30% in 2017.

Furthermore, the market is prioritising expansion of coverage, but currently is not overcoming the issues related to the quality of the water and wastewater treatment, the latter being very poor. Law 11445 also *…"encourages the use of different technologies for the provision of water supply and sanitation. This presents a great opportunity for technological innovation to be implemented in the municipal WSS services. Thus, investment in technologies is also essential in creating the opportunity to expand this market".*

Market forecast 2010 Brazil[1]	
Total water market: 15,373 M USD	
Sector	Share (%)
Utilities	78.8
Bottled water	13.3
Industrial water	4.0
Point of use equipment	3.0
Irrigation equipment	1.1

Market forecast[2]			
Sector (CAPEX)	Time frame	Value (M USD)	Increase / decrease (%)
Drinking water[3]	2007 – 2010	1100 - 2300	+ 109
Waste water networks	2007 - 2016	750 - 1250	+ 67
Waste water treatment plants	2007 - 2016	300 - 650	+ 117
Industrial expenditure	2007 - 2016	390 - 700	+ 79
Water re use[4]	2007 - 2016		
Desalination[2]	2014		

[1] Source – Global Water Market 2011 from the publishers of Global Water Intelligence.

[2] Source – Global Water Market 2011 from the publishers of Global Water Intelligence

[3] This includes water resources (including desalination), water distribution networks (new build and rehabilitation and drinking watertreatment plants (new build and rehabilitation)

[4] No accurate numbers for these sectors. Desalination is not widely used. Water re use will increase. 15 – 25 % of domestic sewage is reused for different purposes.

7.5 Analyses of Scientific Publications

Population: 201 M inhabitants GDP: 1,645 G €

Research Question	Publications			Publications Respect Europe (%)		
	Number	Per M inhab.	Per G € GDP	Number	Per M inhab.	Per G € GDP
Q1: Ecosystems	1,900	9	1	6	20	56
Q2: Citizens	2,522	13	2	7	23	66
Q3: Industry	6,696	33	4	5	16	47
Q4: Bioeconomy	1,487	7	1	10	32	**92**
Q5: Gap	1,251	6	1	6	20	56
All	12,742	63	8	**10**	30	**87**

The publications produced in Brazil in the field of water represent 10% of the European publications. When the number of publications is standardized per GDP, Brazil and Europe can be compared (Brazil is 87% of Europe). When analyzing Brazilian S&T production in the light of the five research questions expressed in the Water JPI SRIA, the main strengths are in the **Bioeconomy** area. The rest of sectors follow, showing similar intensities.

During the studied 15-year period, Brazil has multiplied its publications by 6.0. This is one of the highest increase rates of the analyzed countries, and represents 260% of the European increase in the same period. Brazil publishes with 107 countries, 32 of which are EU Member States and Associated Countries. The International Cooperation Index is 31% and the European Cooperation Index is 14%.

Who

Is publishing with Brazil?

In the world	%	In Europe (MS[1]+AC[2])	%
EU (MS+AC)	13.5	FRANCE	2.7
USA	8.7	GERMANY	2.2
CANADA	1.4	UK	1.7
ARGENTINA	1.1	SPAIN	1.5
AUSTRALIA	1.0	PORTUGAL	1.1

[1]: Member States; [2]: Associated Countries.

Who

is funding this research?

Funding Agencies	%*
NAT COUNCIL FOR SCIENTIFIC AND TECHNOLOGICAL DEVELOP, CNPQ	45.3
COORDENACAO DE APERFEICOAMENTO DE PESSOAL DE NIVEL SUP, CAPES	19.8
FUNDACAO DE AMPARO A PESQUISA DO EST DE SAO PAULO, FAPESP	18.5
FUNDACAO DE AMPARO A PESQUISA DO EST DE MINAS GERAIS, FAPEMIG	4.2
FINANCIADORA DE ESTUDOS E PROJETOS, FINEP	2.3

Which

Institutes are doing the work?

Organizations	%
UNIV SAO PAULO	16.8
UNIV ESTADUAL PAULISTA	7.9
UNIV ESTADUAL CAMPINAS	5.2
UNIV FED RIO DE JANEIRO	5.0
UNIV FED VICOSA	4.0

Analysis per topic:

Who

	Organization	%	Authors	%
Q1	UNIV SAO PAULO	24.9	OLIVEIRA ON	0.6
	UNIV FED RIO DE JANEIRO	7.9	REICHARDT K	0.5
	UNIV BRASILIA	6.5	OLIVEIRA LCA	0.4
	UNIV ESTADUAL MARINGA	5.1	RUBIO J	0.4
	UNIV FED VICOSA	3.8	ZAIAT M	0.4
Q2	UNIV SAO PAULO	24.9	REIS A	0.9
	UNIV ESTADUAL PAULISTA	7.9	LOGUERCIO AD	0.8
	UNIV ESTADUAL CAMPINAS	6.5	RIBEIRO DA	0.8
	UNIV FED RIO DE JANEIRO	5.1	ZAIAT M	0.8
	UNIV FED RIO GRANDE DO SUL	3.8	FORESTI E	0.8
Q3	UNIV SAO PAULO	22.1	OLIVEIRA ON	0.6
	UNIV ESTADUAL CAMPINAS	6.8	REICHARDT K	0.5
	UNIV FED RIO DE JANEIRO	6.4	OLIVEIRA LCA	0.4
	UNIV ESTADUAL PAULISTA	6.3	RUBIO J	0.4
	UNIV FED SANTA CATARINA	3.8	ZAIAT M	0.4
Q4	UNIV SAO PAULO	15.5	GHEYI HR	2.6
	UNIV FED VICOSA	6.1	FOLEGATTI MV	1.8
	UNIV ESTADUAL PAULISTA	6.0	DE MEDEIROS JF	1.7
	UNIV FED CEARA	5.4	FERNANDES PD	1.6
	UNIV FED LAVRAS	4.0	MELFI AJ	1.5
Q5	UNIV SAO PAULO	17.9	COLLISCHONN W	1.0
	UNIV FED VICOSA	5.4	RIBEIRO RV	1.0
	UNIV ESTADUAL PAULISTA	5.3	DAMATTA FM	0.9
	UNIV FED CEARA	4.2	DE MELLO CR	0.9
	UNIV FED RIO DE JANEIRO	3.9	NEPOMUCENO AL	0.9

7.6 Major RDI Programmes

The mayor funding agencies related to water challenges and the Water JPI SRIA are:

CNPQ - NATIONAL COUNCIL FOR SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT

CNPQ is the central organisation that sets the tone for Brazilian policy. Its funding mechanisms are research collaborative projects, scholarships to the training of professionals in all fields of scientific and technological research (both in Brazil and abroad). Two new types of actions have recently been introduced: scholarships for researchers' stays at enterprises and funds for research projects.

Web site: http://www.cnpq.br/

CNPQ participates in the formulation, implementation, monitoring, evaluation and dissemination of the National Policy on Science and Technology, especially to:

- Promote and encourage the development and maintenance of scientific and technological research and training of qualified human resources for research in all fields of knowledge.
- Promote and encourage scientific and technological research and training of human resources aimed at social and economic issues related to the specific needs of national or regional significance relevant sectors.
- Promote and foster technological innovation.
- Promote, implement and maintain mechanisms for the collection, analysis, storage, dissemination and exchange of data and information on the development of science and technology.
- Propose and implement standards and tools that support and encouragement to carry out research and development, diffusion and absorption of scientific knowledge and technological activities.
- Promote the achievement of agreements, protocols, conventions, programs and projects for the exchange and transfer of technology among public and private national and international entities.
- Support and promote meetings of scientific and technological nature or participate in them.
- Promote and conduct studies on the scientific and technological development, etc.

Out of its 14 specific big thematic and/or territorial programmes, two of them are identified for possible reference with water related issues being these:

PELD - Programa de Pesquisa Ecológica de Longa Duração

The Program for Long Term Ecological Research (LTER) is a pioneer funding initiative of long-term research in the country. The Programme focuses on the establishment of permanent research sites in different biomes and ecosystems in the country; it integrates the network for the development and monitoring of long-term ecological research in order to get relevant information about fundamental aspects of Biodiversity Conservation. Since the beginning of the program, there have been three calls which have launched 28 research sites distributed in all the biomes. LTER has been highlighted the scenario of research in ecology in Brazil and it is now focusing in the training of human resources and the consolidation of sites and research teams with long-term approach.

SISBIOTA Brazil - National System of Biodiversity Research

The objective of the National Research System is to promote and expand knowledge of Brazilian biodiversity, improve the predictive ability of responses to global change, particularly to changes in land cover and land use and climate change.

CNPQ funds mostly research through the instruments of projects and mobility grants

Volume[1] of M€ dedicated to Water RDI is not available. Nevertheless the following data can be relevant for the report.

- Total funding in projects in the sciences of Agriculture, Biology, and Health is 132 161 084 US$ or 96 477 591€.
- Total funding in scholarships for research performed in Brazil in the sciences of Agriculture, Biology, and Health is 213,563,391 US$ or 155,901,275 e.
- Total funding in scholarships for Brazilians for research performed abroad in the sciences of Agriculture, Biology, and Health is 58,543,466 US$ or 24,736,730 €

CNPQ has an intensive international collaboration and has established 46 agreements with countries around the globe, such as in map below:

There are several bi-lateral research agreements between Brazil through the National Council for Scientific and Technological Development (CNPq) and many foreign agencies and organizations in European countries. Most of them are umbrella scientific cooperation agreements with national research agencies that often cover exchange of personnel and joint scientific research projects, such as those with DAAD (Deutscher Akademischer Austauschdienstt) of Germany, with CNR (Consiglio Nazionale delle Ricerche d'Italia) of Italy and with FCT (Fundação para a Ciência e a Tecnologia (ex-GRICES) of Portugal. Other agreements have a more disciplinary focus given that the

[1] HTTP://FOMENTONACIONAL.CNPQ.BR/DMFOMENTO/HOME/FMTHOME.JSP?

partner is a national technical research institute or a network of institutes, such as INRIA (Institut National de Recherche en Informatique et en Automatique) of France and MPG (Max-Planck Gesellschaft) of Germany. Some agreements listed below, taken from the CNPq web site, are not valid anymore given that the object of the agreement has ceased to exist, as in the case of the CEB-OXFORD Center for Brazilian Studies of Oxford University (United Kingdom). The list of agreements is:

- Germany
  - DAAD - Deutscher Akademischer Austauschdienstt
  - DFG - Deutsche Forschungsgemeinschaf
  - DLR - Deutsches Zentrum für Luft- und Raumfahrt
  - MPG - Max-Planck Gesellschaft
- Belgium
  - FNRS - Fonds National de la Recherche Scientifique
  - FWO - Fonds voor Wetenschappelijk Onderzoek – Vlaanderen
- Spain
  - CSIC - Consejo Superior de Investigaciones Científicas
  - CEB - Centro de Estudos Brasileiros da Universidade de Salamanca
- France
  - CESMAT - Center d'Etudes Supérieures de Matières Premières
  - CIRAD - Center de Cooperation Internationale en Recherche Agronomique pour le Développement
  - CNRS - Center National de la Recherche Scientifique
  - IAS - Institut Aéronautique et Spatial
  - INRIA - Institut National de Recherche en Informatique et en Automatique
  - INSERM - Institut National de la Santé et la Recherche Medicale
  - IRD - Institut de Recherche pour le Développement
- Italy
  - CNR - Consiglio Nazionale delle Ricerche d'Italia
- Portugal
  - FCT - Fundação para a Ciência e a Tecnologia (ex-GRICES)
- United Kingdom
  - CEB-OXFORD – Centro de Estudos Brasileiros da Universidade de Oxford
  -

THE NATIONAL INSTITUTES OF SCIENCE AND TECHNOLOGY (INCTs)

In 2008 the CNPq created 123 National Institutes of Science and Technology (INCTs) located in 16 different states in Brazil to function as a network with institutions throughout the country playing a strategic role in the National System of Science and Technology. Each INCT is composed of teams from several universities and research centers and serves as a gateway for international collaborations.

INCT de Toxicologia Aquática (INCT-TA) – Aquatic Toxicology INCT

The Aquatic Toxicology Institute objectives are:

- To identify biomarkers in freshwater and coastal/marine species from the Brazilian fauna that could be useful as reference parameters in the establishment of environmental regulations aiming to preserve both continental and coastal waters in Brazil.

- To contribute in the training of high-quality personnel capable to develop advanced studies in Aquatic Toxicology and forefront activities associated with the development and application of chemical, biological and eco-toxicological modelling tools, aiming to preserve the Brazilian water resources and to transfer knowledge to society on different aspects of aquatic contamination and pollution, especially on the threats to environmental and human health, as well as on the need to preserve water resources for our well-being and of the next generations.
- To transfer knowledge to society on different aspects of aquatic contamination and pollution, especially on the threats to environmental and human health, as well as on the need to preserve water resources for our well-being and of the next generations.
- To transfer knowledge to decision makers (governmental agencies) aiming the implementation of a monitoring program on the conservation of Brazilian water resources based on the application of modern tools to detect the biological effects of water contaminants.
-

INCT em Salinidade (INCTSal) INCT in Salinity

Through basic and applied research, the Instituto Nacional de Ciência e Tecnologia em Salinidade INCTSal aims to:

- Diagnose and delimit the land and waters affected by salts;
- Develop knowledge and technologies for solving the problems of agricultural production in areas affected by excess salts in the soil or water areas;
- Ensure sustainable irrigated agriculture by preventing the degradation of soil and water by toxic salts and other elements;
- Contribute to the integration of research conducted in the country in salinity;
- Contribute to the training of human resources for research and action in the productive sector.

CAPES - COORDENACAO DE APERFEICOAMENTO DE PESSOAL DE NIVEL SUPERIOR. - Agency for Support and Evaluation of Graduate Education

CAPES is a Foundation of the Ministry of Education (MEC). It plays a key role in expanding and consolidating *stricto sensu* graduate programs (master and doctorate) in all states of the Federation. CAPES has expanded the scope of their actions in the training of qualified personnel in Brazil and abroad.

CAPES activities can be grouped into the following lines of action, each developed by a structured set of programs:

- Assessment stricto sensu graduate programs;
- Access to and dissemination of scientific literature;
- Investments in the training of high level features at home and abroad;
- Promotion of international scientific cooperation;
- Induction and promotion of initial and continuing training of teachers for basic education in the classroom and distance formats.

CAPES has been instrumental to the successes achieved by the national system of postgraduate, both in respect of the consolidation of the current frame, as in the construction of the changes that the advancement of knowledge and the demands of society require.

CAPES is ranked high on the list of bibliometrics exercise on scientific publications in the areas of Water JPI SRIA as it supports researchers during their postgraduate training in the following areas of research: Biodiversity, Agricultural Science, Environmental Sciences, Biological Sciences, Geosciences, Materials, and Urban and Regional Planning.

FAPESP - FUNDACAO DE AMPARO A PESQUISA DO ESTADO DE SAO PAULO, - São Paulo State Research Foundation

The Foundation for Research Support of the State of São Paulo, FAPESP, is one of the main agencies of promotion of scientific and technological research Brazil. FAPESP is linked to the Department of Economic Science and Technology Development of the Government of the State of São Paulo.

With a corresponding annual budget of 1 % of the total tax revenue of the State, FAPESP funds and promotes research activities, as well as it works in outreach and dissemination of science and technology produced in São Paulo.

FAPESP supports scientific and technological research through the Research Grants in the following areas: Biological Sciences, Health Sciences, Exact and Earth Sciences, Engineering, Agricultural Sciences, Social Sciences, Human Sciences, Linguistics, and Arts and Letters.

The scholarships given by FAPESP are for undergraduate, graduate and PhD students and they are awarded under the following lines Regular Line, Special Programs, and Research Programs for Technological Innovation.

The Regular Line is bottom up, i.e., the project proposals submitted by the initiative of undergraduate and graduate researchers, and doctors. In 2012, FAPESP committed more than US 368 M US$ (268 M €) to finance Regular Scholarships at home and abroad, and 437 M US$ (319 M €) for Regular and Theme Research Projects.

The Special Programs are designed to encourage the development of research that advances the frontiers of knowledge and to meet the demands of the State of São Paulo Science and Technology System and the country. The Programmes include: Support for Young Researchers, Public Education, Infrastructure Support, among others. In 2012, 152 M US$ (110 M €) were dedicated to these programmes.

Research for Technological Innovation Programs supports research with the potential to develop new technologies and practical application in various areas of knowledge, in tune with the policy of Science and Technology of the state government. Among the programs are: Public Policy, Research Partnership for Technological Innovation (PITE) and Innovative Research in Small and Micro Enterprise (PIPE), among others. In 2012, 76.9 M US$ (55 M €) were dedicated to these programmes.

In addition to funding research, FAPESP collaborates actively at an international level. Therefore, it has established partnerships with funding agencies, companies, higher education and research organizations in other countries.

Cooperation agreements include the exchange of researchers and the development of joint research projects. Some of FAPESP's international partners and the corresponding agreements are from the following Water JPI countries: ES, DE, DK, FI, FR, IL, NL, PT, and UK.

FAPESP has a large number of agreements with foreign funding agencies, which can be divided in two types:

a. Agreements offering seed funding, mostly for exchange of researchers and students and small workshops. In this case the foreign partner is generally a university or a research institution. As of 2011 there were 7 agreements of this type.

b. Agreements offering full funding for research projects, selected jointly by FAPESP and the partnering agency. In this case the foreign partner is generally a research funding agency or an industrial research laboratory. As of 2011 there were 26 agreements of this type.

FAPESP is ranked high on the list of bibliometrics on scientific publications in the areas of Water JPI SRIA having a bottom up approach. In spite of the above, FAPESP does not have a specific programme on Water research.

FAPEMIG - FUNDACAO DE AMPARO A PESQUISA DO ESTADO DE MINAS GERAIS

The Foundation for Research Support of the State of Minas Gerais (FAPEMIG) is the only agency that fosters scientific and technological development in Minas Gerais. It is a foundation of the State Government, linked to the Department of State for Science, Technology and Higher Education. FAPEMIG:

- Finances projects of scientific and technological research.
- Encourages the development of human resources for science and technology, through fellowships at various levels of training.
- Contributes to the establishment of groups of scientific and technological research.
- Promotes integration between the productive sector and research and development institutions.
- Supports the realization of events and organizes scientific and technological character.
- Conducts exchanges between Brazilian and foreign researchers, and establishing cooperation links with national and international institutions.
- Through the Office of Technology Management and Patents Act, directs and guides the actions of patenting and commercialization of innovative products or processes.
- Disseminates research results.

Programme: City of Waters

The purpose of City of Waters is to create hubs and raise awareness on the proper use of water, committed to sustainable development, reduce waste, encourage reuse, improve management by using appropriate technologies. Unfortunately it seems to be that this programme might be very new and no more information is found on FAPEMIG website or Google regarding this programme.

FINEP - FINANCIADORA DE ESTUDOS E PROJETOS

FINEP is Brazil's leading agency that supports innovation, liaison among private industry, universities, and non-profit organisations through loans and grant programmes. FINEP is an agency depending on the Ministry of Science, Technology and Innovation.

The support of FINEP covers all stages and dimensions of scientific and technological development cycle: basic research, applied research, development and improvement of products, services and

processes. FINEP also supports the incubation of technology-based companies, the deployment of technology parks, structuring and consolidation of research processes and developing markets.

FINEP operates through the following mechanisms:

- Streaming, funding innovation in enterprises.
- Public Calling: structured selection through a competitive process open to public actions.
- Indirect investment in companies through investment funds.

FINEP programs encompass three broad lines of action:

- Support for innovation in enterprises.
- Support for Scientific and Technological Institutions (ICTs).
- Support for cooperation between businesses and ICT.
- Other Actions, such as:
    - FINEP Innovation Award - created to recognize and promote innovative efforts of companies, or non-profit organisations.
    - Sponsors - Financial support for conducting meetings , seminars and conferences S,T&I, publications and technology fairs and also for cultural and sporting actions.
    - Technology parks - a program targeting the creation of technology parks that aim to develop technological competencies focused on regional vocations or the existence of specific supply chains and by presenting business plans.

FINEP pays a special attention to international cooperation and aims to identify opportunities for exchanges and cooperation and promote partnerships with public and private entities of excellence from other countries and international organizations in order to finance projects and international cooperation activities enabling the set of products, processes, services and innovative development.

National Fund for Scientific and Technological Development (FNDCT)

As from 2011, FINEP has been the FNDCT Executive Secretariat. The National Fund for Scientific and Technological Development is a government budget fund which aggregates revenues from 15 sectorial funds.

Some of its main priorities are:

- R&D cooperation (joint projects, PPP with research institutes);
- Support infrastructure (transfer offices, training of support staff);
- Knowledge Transfer (contract research, licences, research and IPR issues in public/academic/non-profit institutes)
- Support to sectorial innovation in manufacturing
- Support to innovation in services
- Support to innovative start-ups incl. gazelles
- Support to risk capital

Its selected research and technology fields are: Biotechnology, Energy, Food agriculture and fisheries, Health, ICT, Space, Transport, Naval Construction, Aeronautics, Research Infrastructure, Amazon Region, Water Resources, Mining, Oil and Gas Exploration, and the Audio-Visual Industry.

The overall budget for FNDCT for 2012 was 565.6 M€? In 2012, 200.4 M€? (R$542.8m) were transferred to CNPq. A significant part of these resources was used in programmes under their responsibility of CNPq, among which stand out: 'Casadinho' programme (CNPq-CAPES) to support

collaboration of graduate programmes of university centers of excellence with emerging graduate programmes in less developed regions, support for nuclei of excellence (PRONEX), support to Emerging Nuclei (PRONEM), the first projects programme (PPP), researcher in company (RHAE) and Universal Calls. These programmes result from partnerships of CNPq with States, science and technology institutions, companies and researchers.

7.7 Connections between Water JPI SRIA and the RDI programmes and policies of Brazil

SRIA Questions	Rate (1 to 6)*	Brief motivation of the rating
Sustainable ecosystems	4	Despite the strong environmental profile of Brazil, they have not yet reached the point of focusing on ecosystems as much as European countries have. Interest on this topic may quickly increase.
Developing safe water systems for the citizens	5	Protecting citizens from water-related diseases is a major topic of interest in the country, and an area where cooperation can be easy to set-up
Promoting competitiveness in the water industry	6	In comparison with Europe, the weight of this topic is not very strong. However, the recent period of industrial development suggests that this is a hot issue for cooperation.
Implementing a water-wise bio-based economy;	6	Intensity of research and development in this area is very strong, and cooperation on this topic seems to be a sure bet.
Closing the water cycle gap	3	The water gap is not as large as it is in Europe or in other areas of the world. Water shortages are for the most part seasonal.

*1 = weak connection with JPI SRIA

6 = strong connection with JPI SRIA

7.8 Acronyms of BRAZILIAN institutions and reference documents

Acronym	Institution Name	Website
ABDI	Agencia Brasileira de Desenvolvimento Industrial -- Brazilian Industrial Development Agency	http://www.abdi.com.br/
AEB	Agencia Espacial Brasileira – Brazilian Space Agency	http://www.aeb.gov.br/
ANA	National Water Agency	http://www2.ana.gov.br
ANDIFES	Associação Nacional dos Dirigentes das Instituições Federais de Ensino Superior	http://www.andifes.org.br
ANPEI	Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras National Innovative Companies Research, Development and Engineering Association	www.anpei.org.br
ANPROTEC	Associação Nacional de Entidades Promotoras de Empreendimentos de Tecnologias Avançadas – National Association of Entities Promoting Advanced Techonology Entreprises	www.anprotec.org.br
APTEL	Associação de Empresas Proprietárias de Infraestrutura e de Sistemas Privados de Telecomunicações - Association of the Enterprises Holding Infrastructure and Private Systems of Telecommunication	http://www.aptel.com.br/
BNDES	Brazilian Development Bank	http://www.bndes.gov.br
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Federal Agency for Support and Evaluation of Graduate Education	http://www.capes.gov.br/
CBPF	Centro Brasileiro de Pesquisas Físicas – Brazilian Center for Physics Research	http://www.cbpf.br
CGEE	Centro de Gestão de Estudos Estratégicos -- Center for Management and Strategic Studies	http://www.cgee.org.br/
CEMADEN	Centro Nacional de Monitoramento e Alertas de Desastres Naturais	http://www.cemaden.gov.br/
CNI	Confederação Nacional da Industria - National Confederation of Industry	http://www.portaldaindustria.com.br/
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico – National Council of Scientific and Technological Development	http://www.cnpq.br/
CONFAP	Conselho Nacional das Fundações Estaduais de Amparo à Pesquisa – National Council of Research Foundations	http://www.confap.org.br/
CONIF:	Conselho Nacional das Instituições da Rede Federal de Educação Profissional, Científica e Tecnológica – National Council of Federal Network of Professional, Scientific and Technological Institutions	http://www.conif.org.br/
CONSECTI	Conselho Nacional de Secretários Estaduais para assuntos de Ciência, Tecnólogia e Inovação – National Council of State Secretaries in charge of Science, Technology and Innovation issues.	http://www.consecti.org.br/
CSF	Ciência sem Fronteiras – Science without Borders	http://www.cienciasemfro

		nteiras.gov.br
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária - Brazilian Agricultural Research Corporation	http://www.embrapa.br/
EMBRAPII	Empresa Brasileira de Pesquisa e Inovação Industrial – Brazilian Industrial Research and Innovation Corporation	
ENCTI	Estratégia Nacional 2012 - 2015 Ciência, Tecnologia e Inovação – National Science Technology and Innovation Strategy	http://www.mct.gov.br/index.php/content/view/336399/Estrategia_Nacional_de_Ciencia_Tecnologia_e_Inovacao_2012_2015_e_Balanco_das_Atividades_Estruturantes_2011.html
FACEPE	Fundação de Amparo a Ciência e Tecnologia do Estado de Pernambuco – Pernambuco State Science and Technology Foundation	http://www.facepe.br/
FAPEAM	Fundação de Amparo à Pesquisa do Estado do Amazonas – Amazonas State Research Foundation	http://www.fapeam.am.gov.br/
FAPEMA	Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão – Maranhão State Research and Technology Foundation	http://www.fapema.br/site2012/
FAPEMIG:	Fundação de Amparo à Pesquisa do Estado de Minas Gerais – Minas Gerais State Research Foundation	http://www.fapemig.br/
FAPERJ:	Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro – Rio de Janeiro State Research Foundation	http://www.faperj.br/
FAPESP	Fundação de Amparo a Pesquisa do Estado de São Paulo – São Paulo State Research Foundation	http://www.fapesp.br/
FAPESPA	Fundação Amazônia Paraense de Amparo à Pesquisa – Para State Amazon Research Foundation	http://www.fapespa.pa.gov.br/
FAP	Tumucumaque: Fundação de Amparo à Pesquisa do Estado do Amapá – Amapa State Research Foundation	http://www.ap.gov.br/amapa/tumucumaque/paginas/institucional/historico.php
FINEP	Financiadora de Estudos e Projetos – Studies and Projects Finance Organization	http://www.finep.gov.br/
FIOCRUZ	Fundação Oswaldo Cruz - Foundation Oswaldo Cruz	http://portal.fiocruz.br/
GCUB	Grupo Coimbra de Universidades Brasileiras – Coimbra Group of Brazilian Universities	http://www.grupocoimbra.org.br/
IBE	Instituto de Estudos Brasil Europa – Institute for Brazil Europe	http://www.ibe.usp.br
IMPA	Instituto Nacional de Matematica Pura e Aplicada – National Institute of Pure and Applied Mathematics	http://www.impa.br
INCT	Institutos Nacionais de Ciência e Tecnologia – National Institutes of Science and Technology	http://www.inct-ta.furg.br/
INPA	Instituto Nacional de Pesquisas da Amazonia – National Institute for Amazonian Research	http://www.inpa.gov.br/
INPE	Instituo Nacional de Pesquisas Espacias – National Institute for Space Research	http://www.inpe.br/

ITA	Instituto de Tecnologia de Alimentos – Institute of Food Technology	http://www.ital.sp.gov.br/
LNCC	Laboratório Nacional de Computação Científica – National Laboratory for Scientific Computing	http://www.lncc.br
LNLS	Laboratório Nacional de Luz Síncrotron - Brazilian Synchrotron Ligth Laboratory	http://lnls.cnpem.br/
MEC	Ministério da Educação – Ministry of Education	http://portal.mec.gov.br
MCTI	Ministério da Ciência, Tecnologia e Inovação – Ministry of Science Technology and Innovation	http://www.mct.gov.br/
MME	Ministério de Minas e Energia – Mines and Energy Ministry	http://www.mme.gov.br/mme
MPA	Ministério da Pesca e Aquicultura – Fisheries and Aquaculture Ministry	http://www.mpa.gov.br/
PBM	Plano Brasil Maior – Greater Brazil Plan	http://www.brasilmaior.mdic.gov.br/
PUCRS	Pontifícia Universidade Católica do Rio Grande do Sul – Pontifical Catholic University of Rio Grande do Sul	www.pucrs.br
SEBRAE:	Serviço Brasileiro de Apoio a Micro e Pequenas Empresas - Brazilian Service of Support for Micro and Small Enterprises	http://www.sebrae.com.br/
SENAC:	Serviço Nacional de Aprendizagem Comercial	http://www.senac.br/
SIBRATEC:	Sistema Brasileiro de Tecnologia – Brazilian Technology System	http://www.brasil.gov.br/sobre/science-and-technology/fostering-andsupport/sibratec/br_model1?set_language=en

8. INDIA

8.1 Context and RDTI

India is home to 17% of the world population while it has only 2.1% of the geographic reach. In the last decades India developed itself to an urban industrial/service led economy. More industry in the urban area led to a huge migration from the rural area to the cities. Because of this, the urban share in India's population has steadily increased from 17% in 1951 to 31% in 2011. In 1951, only five cities had more than a million inhabitants, today there are 51 of such cities[1]. In the rural area the agriculture sector developed fast and is still modernizing.

Key research priorities

From this short analysis we can derive a set of key priorities in research and innovation.

- Integrated waste water treatment technologies and management
- Water quality monitoring
- Water purification for safe drinking
- Water use efficiency in agriculture
- Urban water management including water reclamation and reuse
- Water purification, water quality and health issues
- Waste water treatment for safe reclamation and reuse
- Integrated water resource management
- Flood routing, forecasting and management
- Capacity building

8.2 Water challenges

Urbanisation and Industrialization

The consequences of these trends are huge. Existing drinking water systems do not longer meet with the standards needed. Most of the drinking water systems in the cities are old and not well maintained. Neither is there a proper monitoring system. Unaccounted water loss in distribution in most of the cities in India is estimated to be around 35%. In most cities citizens have a daily access to water that ranges from 1-6 hours. The availability of potable water in the urban area is under pressure because of the demand Just 30% of the waste water from urban areas is treated, while the rest finds its way into the natural systems. Water for industry is competing with drinking water. The need for process water will increase in the coming years.

Rural areas

Despite the exodus of the rural area to the cities there has been a threefold increase of area of land being brought in to agriculture for the production of mainly wheat and rice with a fourfold enhancement in per ha production. The consumption of water for agriculture is up to 90% of the

[1] Source: Hindustan Times, December 2013

total of 581 km³ (source KPMG, 2010) And although more sophisticated irrigation systems are introduced on the Indian market, most of the irrigation is still traditional with an efficiency of no more than approximately 40%.

It may also be noted that water pollution is becoming a serious problem in the rural areas of India. It is mainly caused by the discharge of domestic sewage directly or indirectly into water bodies, agricultural run-off during rainy season containing chemical fertilizers and pesticides as well as effluents from agro-based industries.

Another severe development in the rural areas is that because of the discharge for irrigation the groundwater has become more and more saline and thus more or less a threat for plant breeding.

Drought and floods

The developments in water described until now are a direct consequence of anthropogenic acting. Drought and floods are influence the availability of potable water to a high extent, independently whether they are caused by climate change or not.

Droughts will inevitably lead to exhaustion of groundwater bodies Of all 5723 blocks assessed across India by the Central groundwater Authority 839 have been found over exploited, 550 semi critical and 226 are classified as critical (source: Central Groundwater Authority).

Floods mainly originate from heavy rainfall in a large area during monsoon periods. In general, they are caused by a lack of storage capacity or by natural barriers like sandbanks in the river. Floods badly affect the water supply by damaging sewage plants. It often results in serious outbreaks of epidemics like cholera.

8.3 Institutional framework

Many public and private institutions have been performing research and development activities in water area. Lot of joint research with international organizations has been witnessing since functioning of S&T cooperation agreements between India and other countries. The World Bank finances a number of projects in urban and rural areas that are fully or partly dedicated to water supply and sanitation. Some of the ministries like Ministry of Water Resource (MWR), Central Soil and Materials Research Station (CSMRS), Central Water Commission (CWC), Central Water and Power Research Station (CWPRS), National Water Development Agency (NWDA), Central Ground Water Board (CGWB), DST, DBT, CSIR, etc. have been sponsoring various research activities with regard to water, waste water and other water related topics. Some institutions like Indian Council of Agricultural Research, National Environmental Engineering Research Institute have been funded in water research activities.

8.4 Water use and market overview

Water use In India[1]				
Sector	Sectorial water use 2005 (Billion m^3 / y)	%	Sectorial water use 2025 (Billion m^3 / y)	Increase (%)
Irrigation	688	85	910	32
Public supply	56	7	73	30
Industry	12	1	23	92
energy	5	1	15	200
other	52	6	72	38
Total	**813**	**100**	**??**	**??**

India's current water supply is approximately 740 billion m^3. By 2030, demand in India will grow to almost 1.5 trillion m^3, driven by domestic demand for rice, wheat, and sugar for a growing population, a large proportion of which is moving toward a middle-class diet. Water savings can be achieved by a "more crop per drop" approach. The challenge for India's agricultural sector is that it is extremely fragmented and based on small scale farming. Upscaling in agriculture will be trend in the near future. Ground water depletion, climate variability and inefficient irrigation are serious threats.

As a result, most of India's river basins could face severe deficit by 2030 unless concerted action is taken, with some of the most populous—including the Ganga, the Krishna, and the Indian portion of the Indus—facing the biggest absolute gap. India shows an enormous growth in urbanization which has a great effect on drinking water and sanitation. By 2030 there will be 68 cities with a population of 1 M inhabitants plus, up from 42 M inhabitants today. Europe has 35 M inhabitants today. There is a great demand for low cost (decentralized) systems or alternatives like desalination or (costly) long distance transport. [2]

[1] Source: Central Water Commission 2005

[2] Source: 2030 Water Resources Group

Market forecast 2010 India[1]	
Total water market: 6273 M USD	
Sector	Share (%)
Utilities	62.2
Industrial water	13.6
Point of use equipment	11.5
Bottled water	11.4
Irrigation equipment	1.3

Market forecast[3]			
Sector (CAPEX)	Time frame	Value (M USD)	Increase / decrease (%)
Drinking water[2]	2007 – 2010	1250 - 2900	+ 132
Waste water networks	2007 - 2016	370 - 650	+ 75
Waste water treatment plants	2007 - 2016	50 - 400	+ 700
Industrial expenditure	2007 - 2016	620 - 920	+ 48
Water reuse	2007 - 2016	25 - 225	+ 800
Desalination	2014	400	+ 10 -15 % per year

[1] Source – Global Water Market 2011 from the publishers of Global Water Intelligence.

[2] This includes water resources (including desalination), water distribution networks (new build and rehabilitation and drinking water treatment plants (new build and rehabilitation)

8.5 Analyses of scientific publications

Population: 1,210 M inhabitants GDP: 1,369 G €

Research Question	Publications			Publications Respect Europe (%)		
	Number	Per M inhab.	Per G € GDP	Number	Per M inhab.	Per G € GDP
Q1: Ecosystems	1,941	2	1	6	3	69
Q2: Citizens	3,347	3	2	10	5	105
Q3: Industry	9,318	8	7	7	4	79
Q4: Bioeconomy	2,151	2	2	15	8	**160**
Q5: Gap	1,665	1	1	8	4	90
All	14,506	12	11	**11**	6	**118**

The publications produced in India in the field of water represent 11% of the European publications. When the number of publications is standardized per GDP, India and Europe can be compared (India is 118% of Europe). When analyzing Indian S&T production in the light of the five research questions expressed in the Water JPI SRIA, the main strengths are in the **Bioeconomy** area, followed by the Citizens and Gap areas. Ecosystems and Industry have the lowest intensity.

During the studied 15-year period, India has multiplied its publications by 4, which represents 153% of the European increase in the same period. India publishes with 116 countries, 27 of which are EU Member States and Associated Countries. The International Cooperation Index is 26% and the European Cooperation Index is 8%.

Who is publishing with India?

In the world	%	In Europe (MS+AC)	%
EU (MS+AC)	8.0	GERMANY	1.9
USA	5.5	UK	1.4
JAPAN	1.3	FRANCE	1.1
CANADA	1.2	NETHERLANDS	0.8
AUSTRALIA	1.2	SWEDEN	0.4

Who is funding this research?

Funding Agencies	%*
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, CSIR	28.5
DEPARTMENT OF SCIENCE AND TECHNOLOGY GOVERNMENT OF INDIA	24.4
UNIVERSITY GRANTS COMMISSION, UGC	17.7
DEPARTMENT OF BIOTECHNOLOGY, GOVERNMENT OF INDIA, DBT	10.6
INDIAN COUNCIL OF AGRICULTURAL RESEARCH, ICAR	4.3

Which Institutes are doing the work?

Organizations	%
INDIAN INSTITUTE OF TECHNOLOGY IIT	12.5
COUNCIL OF SCIENTIFIC INDUSTRIAL RESEARCH CSIR INDIA	12.1
INDIAN INSTITUTE OF TECHNOLOGY IIT KHARAGPUR	3.0
INDIAN AGRICULTURAL RESEARCH INSTITUTE	2.9
INDIAN INSTITUTE OF TECHNOLOGY IIT ROORKEE	2.6

Analysis per topic:

Who is leading?

	Organization	%	Authors	%
Q1	COUNCIL OF SCIENTIFIC INDUSTRIAL RES CSIR	9.2	KUMAR A	1.9
	INDIAN INSTITUTE OF TECH IIT	8.0	KUMAR S	1.9
	INT. CROPS RES. INST. SEMI ARID TROPICS ICRISAT	5.2	VADEZ V	1.8
	INDIAN AGRICULTURAL RESEARCH INSTITUTE	4.8	KUMAR R	1.2
	NATIONAL INSTITUTE OF OCEANOGRAPHY INDIA	3.5	JALEEL CA	1.2
Q2	COUNCIL OF SCIENTIFIC INDUSTRIAL RES CSIR	14.6	MOHAN SV	1.4
	INDIAN INSTITUTE OF TECHNOLOGY IIT	11.5	KUMAR A	1.2
	JADAVPUR UNIVERSITY	3.2	CHAKRABORTI D	1.2
	NATIONAL ENVIRONMENTAL ENG. RES INSTITUTE	2.9	FLORA SJS	1.2
	INDIAN INSTITUTE OF TOXICOLOGY RESEARCH	2.4	SINGH S	1.2
Q3	COUNCIL OF SCIENTIFIC INDUSTRIAL RES CSIR	19.5	KUMAR A	1.9
	INDIAN INSTITUTE OF TECH IIT	14.5	KUMAR S	1.2
	BHABHA ATOMIC RESEARCH CENTER	4.5	ANIRUDHAN TS	0.8
	INDIAN INSTITUTE OF TECH IIT KHARAGPUR	3.1	KUMAR R	0.7
	INDIAN INSTITUTE OF SCIENCE IISC BANGLORE	2.4	ASWAL VK	0.7
Q4	INDIAN INSTITUTE OF TECH IIT	11.0	KUMAR A	2.6
	COUNCIL OF SCIENTIFIC INDUSTRIAL RES CSIR	6.4	SINGH R	2.2
	INDIAN AGRICULTURAL RESEARCH INSTITUTE	5.7	SINGH S	1.8
	PUNJAB AGR UNIV	5.3	KUMAR S	1.5
	INDIAN INSTITUTE OF TECH IIT KHARAGPUR	4.8	SINGH AK	1.5
Q5	INDIAN INSTITUTE OF TECH IIT	15.2	JALEEL CA	2.6
	COUNCIL OF SCIENTIFIC INDUSTRIAL RES CSIR	9.0	PANNEERSELVAM R	2.0
	INDIAN INSTITUTE OF TECH IIT KHARAGPUR	4.8	KUMAR A	1.6
	INDIAN AGRICULTURAL RESEARCH INSTITUTE	3.5	KUMAR S	1.5
	INT. CROPS RES. INST. SEMI ARID TROPICS ICRISAT	3.4	MANIVANNAN P	1.3

8.6 Major RDI programmes

There are four Departments relevant for the Water JPI. Department for Science & technology (**DST**, Department for Bio Technology (**DBT**), the Indian Council for Agricultural Research (**ICAR**), the Department for Scientific and Industrial Research (**DSIR**) and acting under DSIR there is the Council of Scientific and Industrial Research (**CSIR**) (Figure 3) . Figure 4 shows the national R&D expenditure by sector.

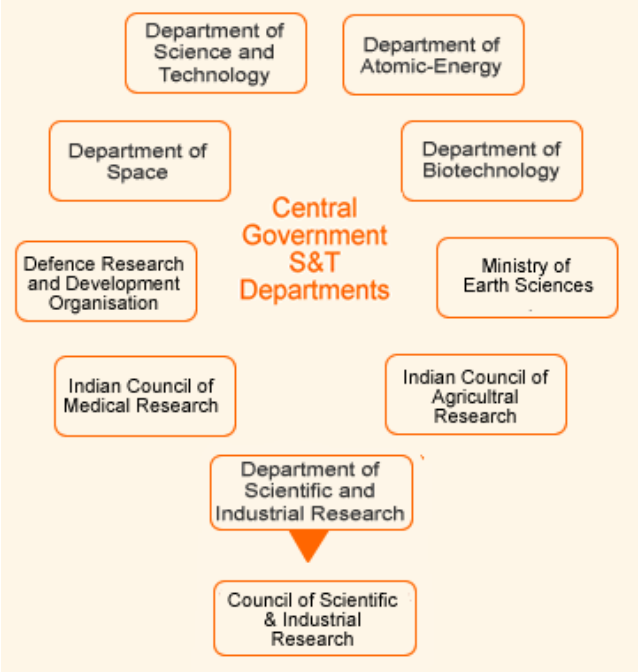

Figure 3 - Departments identified in the Indian Government Structure

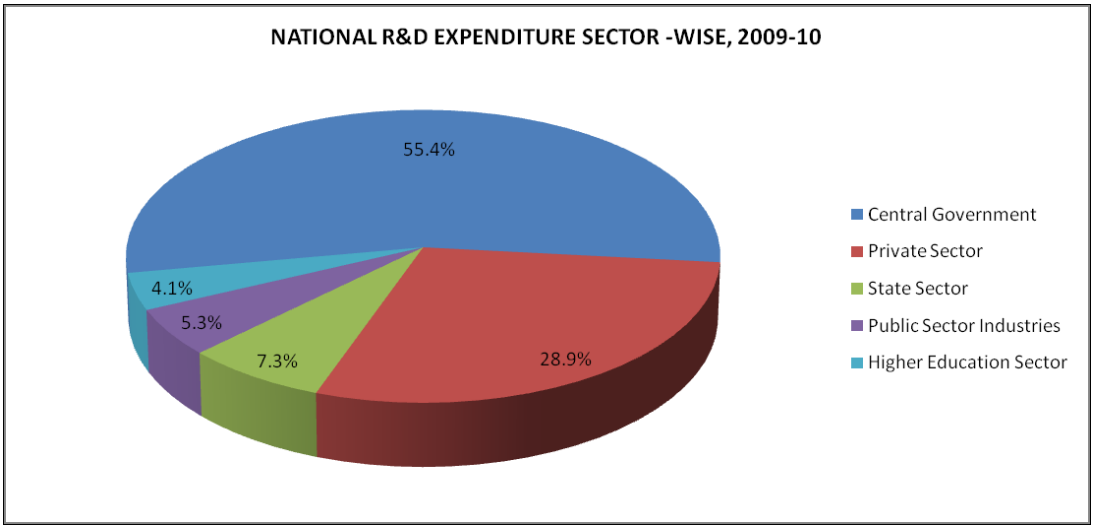

Figure 4 - National R&D expenditure by Sector.

The Department of Science and Technology (DST) and Department of Biotechnology (DBT) were the two major players contributing nearly 50% of the extramural R&D support in the country[1].

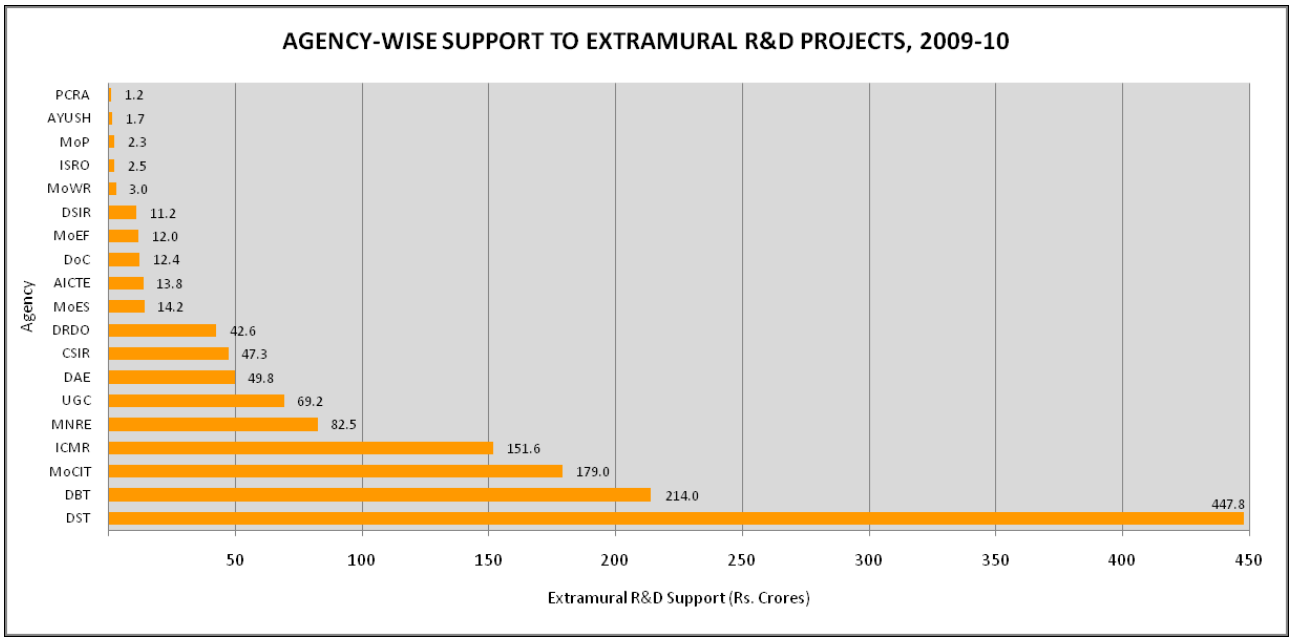

Figure 5 - Support to Extramural R&D projects, 2009-2010

[1]Source: http://www.nstmis-dst.org/PDF/FINALRnDStatisticsataGlance20111121.pdf

DST – Department for Science & Technology

Department of Science & Technology (DST) was established in May 1971, with the objective of promoting new areas of Science & Technology and to play the role of a nodal department for organising, coordinating and promoting S&T activities in the country. DST acts under the Ministry of Science & Technology. The Department has major responsibilities for specific projects and programmes as listed below:

1. Formulation of policies relating to Science and Technology.
2. Matters relating to the Scientific Advisory Committee of the Cabinet (SACC).
3. Promotion of new areas of Science and Technology with special emphasis on emerging areas.
   i) Research and Development through its research institutions or laboratories for development of indigenous technologies concerning bio-fuel production, processing, standardization and applications, in co-ordination with the concerned Ministry or
   ii) Department; Research and Development activities to promote utilization of by-products to development value added chemicals.
4. Coordination and integration of areas of Science & Technology having cross-sectorial linkages in which a number of institutions and departments have interest and capabilities.
5. Undertaking or financially sponsoring scientific and technological surveys, research design and development, where necessary.
6. Support and Grants-in-aid to Scientific Research Institutions, Scientific Associations and Bodies.

7. Promotion of Science and Technology at the State, District, and Village levels for grass- roots development through State Science and Technology Councils and other mechanisms.

Figure 6 - The structure of the Department of Science & Technology (DST)

Water related programmes of DST

DST is implementing **Water Technology Initiative (WTI)**, a research based programme aimed at development and proving of low cost convergent technology solutions for domestic application to ensure safe drinking water quality under real life conditions. The programme encourages indigenous research initiatives for addressing issues related to water availability, water purification and water reuse and recycling. The initiative also encourages scientific evaluation of technologies and preparing of database of technologies for referencing them in specific social context. Capacity Building of Academic/ R&D Institutions and State S&T Councils in conducting R&D activities for addressing water challenges also falls in the mandate of the programme. The programme activities thus include development of database to recognize and rank water purification technologies for decentralized applications, capacity building of indigenous R&D institutions and academics, development, field assessment and pilot testing of technology options for drinking water purification. The focus of the programme has been on design and development of low cost solutions for domestic use of technologies for ensuring safe drinking water.

Water Challenged sites

DST seeks for research based solutions for meeting the prevailing water challenge in various water challenged sites in India identified by States under an exercise conducted by DST. This list can be found at the website of DST and gives a good overview on urgent water issues in the various states

Technology Mission WAR for Water (Winning, Augmentation, Renovation)

Problems associated with water can be broadly grouped as a) availability of water, b) poor quality of water for the intended use and c) indiscriminate use of a valuable natural resource namely water. The technological approaches for solving the problems may therefore emanate from a) Winning water from sustainable resources, b) Augmentation of quality of water from available and accessible

sources and c) Renovation for recycle. A Technology Mission on Winning, Augmentation and Renovation (WAR) for water is proposed to address the directives of the Supreme Court of India to the Union Ministry of Science and Technology. The proposed mission is to undertake research-led solutions through a national and coordinated approach. The Technology mission WAR for Water is developed on the principle that timely, urgent, cost effective, socially viable and sustainable techno-management solutions are required for solving problems of water scarcity.

International cooperation of DST

The International S&T Cooperation Programmes are aimed at complementing and supplementing national efforts of doing world class R&D in different areas of national priority at competitive cost and in most efficient manner. The Cooperation activities are implemented through various types of modes of cooperation which include bilateral mode; regional cooperation mode and multilateral cooperation mode. During 10th Five Year Plan (2002 – 2007), Bilateral Cooperation activities were implemented through intergovernmental agreements signed with 67 countries. Regional cooperation activities were implemented under the aegis of mechanisms such as SAARC, BIMSTEC, ASEAN, IOR-ARC and multilateral activities under STEPAN, UNESCO, TWAS, NAM S&T Center and IBSA Cooperation. In addition, support and facilities were extended to Indo-US S&T Forum; Indo-French Center for Promotion of Advanced Research (IFCPAR) and NAM S&T Center. During the 10th Five year plan, the focus of International S&T Cooperation Programmes was primarily aimed at providing the Indian scientists and engineers the following opportunities:

- To share their R&D efforts and excitement with fellow researchers in partner countries;
- To gain access to research facilities abroad which are not available in the country;
- To share research cost and output;
- To gain from each other's experience;
- To participate in mega science research projects;
- To participate in major international research facilities;
- To demonstrate Indian S&T capabilities; and
- To create world class facilities/centers of excellence/ joint centers.

International agreements

DST has RDI cooperation agreements in different technology fields with Argentina, Armenia, Australia, Bangladesh, Belarus, Brazil, Bulgaria, Canada, China, Colombia, Croatia, Cuba, Czech Republic, Cyprus, Egypt, Estonia, European Union, France, Germany, Hungary, Iceland, Indonesia, Iran, Israel,; Italy, Japan, Kazakhstan, North Korea, Kyrgyzstan, Laos, Lebanon, Libya, Malaysia, Mauritius, Mexico, Moldova, Mongolia, Mozambique, Myanmar, Namibia, Nepal, Northern Ireland, Oman, Peru, Philippines, Poland, Portugal, Russia, Romania, South Korea, Serbia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Switzerland, Syria, Tajikistan, Thailand, the Netherlands, Trinidad & Tobago, Tunisia, Turkey, Ukraine, USA, United Kingdom, Uzbekistan, Venezuela, Vietnam, Yemen, and Zambia.

About 400 Joint R&D projects and over 40 Joint workshops/ seminars were supported in 2012 / 2013. More than 600 exchange visits took place under various bilateral programs for joint research, information, exchange and joint use of facilities and seminars/ training schools supported.

In the EU's Seventh Framework Program, India is fourth largest international partner for science and technological development. In FP7 Environment sector/theme, there are around 18 EU-India projects of which four projects are focused on the water related topic.

DBT – Department for BIO technology

The Department of Biotechnology (DBT) is an Indian government department, under the Ministry of Science and Technology responsible for administrating development and commercialization in the field of modern biology and biotechnology in India. The department has made significant achievements in the growth and application of biotechnology in the broad areas of **agriculture, health care, animal sciences, environment, and industry**.

Duties of the Department

1. To evolve policies and integrated programmes in biotechnology and ensure their implementation and monitoring.

2. To identify specific programmes of Research and Development and manufacturing in biologicals and biotechnology and oversee the initiation and pursuit of related research and manufacturing activities.

3. To identify, set up and support Centers of Excellence for Research and Development in biotechnology and ensure proper dovetailing of their activities as per national priorities and objectives.

4. To act as a screening, advising and approving agent of the Government with regard to import and transfer of new technologies for the manufacture of biologicals, biotechnological products and their intermediates.

5. Evolve safety guidelines for biotechnology Research and Development and manufacturing in India.

6. To act as the central agency for the import of genetically manipulated materials, culture, cells, specimens, tissues and biotech products including DNA and RNA of any type or size and for promoting their production in the country.

7. Serve as the interministerial and interagency nodal point for all specific international bilateral and multilateral Research and Development collaborations and agreements in the area of biotechnology; act as the nodal point for all technology transfers in the area of biotechnology.

8. Manufacture and ensure application of recombinant, cell-based and DNA vaccines, diagnostics and other biotechnological products.

9. To evolve programmes for Human Resource Development in the area of biotechnology.

Serve as an administrative and implementing Department of agencies, commissions, boards, etc. specifically formed by the Government for fulfilling the national objectives in biotechnology and also to serve as the nodal point for Bio-informatics including training and creation of infrastructure, collection, dissemination and exchange of information relating to biotechnology.

DBT executes many programmes related to biology and biotechnology. There are **no specific water RDI programmes** but in many projects there is a close link to water. For example, a better water and nutrient utilization of plants, fruits and vegetables.

One of the main programmes at DBT is the **Biodiversity Conservation and Environmental Biotechnology programme.** The overall aim of this programme is to solve environmental problems in a sustainable way through the use of biotechnology. Main focus is on the development of mitigation technologies for Climate Change, Development of microbial technologies for environmental

improvement, Development of treatment process of industrial effluent, Bioremediation of xenobiotic compounds, Biodiversity conservation and characterization.

International cooperation at DBT

The International Cooperation in DBT envisages fostering international linkages in Biotechnology in order to:

- Assist in implementation of national programmes through transfer of knowledge between various countries
- Open avenues for interaction in areas leading to acquisition of knowledge available within the country
- Building bridges to promote and strengthen bilateral ties through participation in joint R&D programmes
- Capacity building in high–tech areas through training and exchange programmes Share expertise in S&T and large scale facilities with developed and developing nations
- Understand the different cultural approaches to scientific research
- Add to the economic well-being of the country

Currently, DBT has bilateral programmes with the following countries: Australia, Denmark, Canada, Finland, Germany, Netherlands, Norway, Spain, Sweden and Switzerland.

DBT funds projects on various aspects of water including water monitoring using biosensors. Under the international program three ongoing projects in water: One is an EU coordinated project **Water4crops**; and **two are with Finland (Salmonella H2O test and Canada (Remote sensing network for water quality management)** respectively under bilateral program.

RDI budgets of DBT

In 1986/1987 the RDI budget of DBT was 2.7 M€ and increased in 2012/2013 to 175 M€. In 2012 / 2013 there were 1900 project proposals submitted and out of these 667 proposals were granted.

The Indian Council of Agricultural Research (ICAR)

The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture, Government of India. Formerly known as Imperial Council of Agricultural Research, it was established **on 16 July 1929**. The ICAR has its headquarters at New Delhi.

The Council is the body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 99 ICAR institutes and **53 agricultural universities** spread across the country this is one of the largest national agricultural systems in the world.

The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has **enabled the country to increase the production of food grains by 4 times, horticultural crops by 6 times, fish by 9 times (marine 5 times and inland 17 times), milk 6 times** and **eggs 27 times** since 1950-51, thus making a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields.

The main departments of ICAR are: Crop Sciences, Horticulture, Natural Resources Management, Agricultural Engineering, Animal Sciences, Fisheries and Agricultural Education.

There are no specific water programs although it is evident that water and agriculture are closely linked with each other. ICAR has a partnership with the International Water Management Institute and bilateral or multilateral projects with US, Sweden, Canada, Australia, Singapore, New Zealand, and Czech Republic.

University Grant Commission

The UGC was formally established only in November 1956 as a statutory body of the Government of India through an Act of Parliament for the coordination, determination and maintenance of standards of university education in India. In order to ensure effective region-wise coverage throughout the country, the UGC has decentralised its operations by setting up six regional centers at Pune, Hyderabad, Kolkata, Bhopal, Guwahati and Bangalore. The head office of the UGC is located at Bahadur Shah Zafar Marg in New Delhi, with two additional bureaus operating from South Campus of University of Delhi as well.

UGC has many fellowship programmes with foreign countries http://www.ugc.ac.in/ugc_ic.aspx

Council for Scientific and Industrial Research

The Council of Scientific & Industrial Research (CSIR) is the industrial R&D organization in India and was constituted in 1942. The aims of CSIR are to provide industrial competitiveness, social welfare, strong S&T base for strategic sectors and advancement of fundamental knowledge.

CSIR is recognised as one of the world's largest publicly funded R&D organisations having linkages to academia, R&D organisations and industry. CSIR has 37 laboratories spread over the CSIR is also party to the Global Research Alliance with the objective of applying global knowledge pool for global good through global funding. CSIR's R&D portfolio embraces almost all technological areas.

CSIR laboratories involved in water technology.

CSIR laboratories viz, National Chemical Laboratory (Pune), Central Salt & Marine Chemical Research Institute (Bhavnagar), National Environmental Engineering Research Institute (Nagpur), are working in R&D areas of safe drinking water. Besides other laboratories viz, National Geophysical Research Institute (Hyderabad), National Institute of Oceanography (Goa). and Central Glass & Ceramic Research Institute (Kolkata), are also working on water related issues.

National Chemical Laboratory (NCL)

They work in catalysis, biotechnology, organic chemical technology, and polymers and other high performance materials. Basic research in chemistry and biochemistry.

Central Salt & Marine Chemical Research Institute (CSMCRI)

They work on Inorganic chemicals: (i) Development of technologies for recovery of common salt, industrial salt, iodized salt, low sodium salt, and marine chemicals like potash, bromine, and magnesium chemicals. Design and layout of salt farm including salt engineering. Proto type device for improvement and quality control of salt. (ii) Development of technologies for specialty siliceous chemicals, zeolites, clays waste utilization for value added products, and recovery of metals from solid wastes.

Polymer and Membrane Science: Preparation of reverse osmosis and electrodialysis membrane for safe drinking water. Devices for domestic water purification, concentrating aqueous herbal extracts, animal powdered desalination units. Development of spiral elements for large-scale sewage water

treatment plants. Developments of resins for brine purifications, resins for nitrate, arsenic, and fluoride removal.

Bio-salinity: (i) Identification and cultivation of commercially important seaweeds, development of an innovative techniques for simultaneous preparation of carrageenan and liquid fertilizer, quality agarose, bacteriological grade agar, C-phycocyanin (Bio-pigment). Studies on environmental audit and marine impact assessment for scheduled Industry. (ii) Restoration of ecology of wastelands and saline lands. Basic research on plant physiology, biochemistry, molecular biology, agriculture, chemistry, and genetics. Assessment and performance of desert economic and halophytes plants.

National Environmental Engineering Research Institute (NEERI)

Main areas are: Pollution monitoring and mitigation systems and devices; Industrial waste minimization and clean-up; Developing green technologies for environment; Environmental impact and risk assessment and audit; Molecular environmental nanotechnology; Environmental nanotechnology; Genomics enabled environmental biotechnology;

Predictive modelling of multimedia environmental quality; Quantification of environmental complexity; and Vulnerability of water resources.

8.7 Connections Between Water JPI SRIA and the RDI programmes and policies of the country

SRIA Questions	Rate (1to 6)*	Brief motivation of the rating
Sustainable ecosystems	2	Sustainable eco systems as defined in the SRIA of the JPI will become important in India in the future but at his moment India is facing more urgent water issues to solve. On the other hand India is doing a lot of research on ground- and surface water (e.g. Ganga project) and water management in order to improve quality and quantity of water for citizens, agriculture and industry.
Developing safe water systems for the citizens	6	Polluted ground water with fluoride and arsenic are major threats for the population in India. The water challenged sites created by DST show that in many states in India this is a serious issue. DST provides funds for the development of affordable and sustainable solutions. Also the ministry of water resources has funds available to improve water quality to meet the standards of WHO. Particular in rural areas sanitation and healthy drinking water are important issues.
Promoting competitiveness in the water industry	5	The water industry in India is growing rapidly and is internationally oriented. There is still a gap between academia and industry but it is getting smaller. This is also the case between the governmental institutions and the industry. The Indian market is very price sensitive and Indian companies look for innovative niche technologies to stay competitive in the market. There is a strong will for cooperation with foreign partners.
Implementing a water-wise bio-based economy;	6	Due to an increasing population and the upcoming bio based economy water for agriculture will increase in the coming years. ICAR provides funds to increase yield in combination with sustainable water use. It is already a problem in India and it will increase in the coming years.
Closing the water cycle gap	5	Water for citizens, industry and agriculture is competing with each other. Economic growth can only be realized with a sustainable use of water. It is expected that India will face huge gaps in the near future. Research related to this topic is promoted in India and there is a good connection with the Water JPI.

*1 = weak connection with Water JPI SRIA

6 = strong connection with Water JPI SRIA

8.8 Acronyms of INDIAN institutions and reference documents

Acronym	Institution Name	Website
CSMCRI	Central Salt & Marine Chemical Research Institute	http://www.csmcri.org/
CWC	Central Water Commission	www.CWC.nic.in
DBT	Department for Bio Technology	www.dbt.gov.in
DST	Department for Science & Technology	www.dst.gov.in
	Overview of water challenged sites	http://dst.gov.in/scientific-programme/Water_Challenged_Sites_for_Research_Based_Solution.pdf
	Eleven fifth year plan 2007 - 2012:	http://dst.gov.in/about_us/11th-plan/rep-dst.pdf
CGWB	Central Ground Water Board	www.cgwb.gov.in
CSIR	Council of Scientific and Industrial Research	www.csir.res.in
	List of CSIR laboratories and their programmes	http://csirhrdg.nic.in/res-annex-IV.htm
ICAR	The Indian Council for Agricultural research	www.icar.org.in
	India Gate project	http://www.access4.eu/india/index.php?hg=0
	Report on funding organisations	http://www.access4.eu/_media/D.2.4_Database_on_funding_organisation.pdf
	S&T landscape in India	http://www.access4.eu/india/523.php
	EU – India S&T cooperation	http://www.access4.eu/india/525.php
	Useful documents on EU – India cooperation:	http://www.access4.eu/india/514.php
MDWS	Department of Water Supply, Ministry of Rural Development	www.mdws.gov.in
MOUD	Ministry of Urban Development	www.moud.gov.in
NEERI	National Environmental Engineering Research Institute	http://www.neeri.res.in
NWDA	National Water Development Agency	www.nwda.gov.in
UGC	University Grant Commission	www.ugc.ac.in
	International cooperation at UGC	http://www.ugc.ac.in/ugc_ic.asp
WRMIN	Ministry of Water Reources	www.wrmin.nic.in
WTI	Water Technology Initiative programme	http://www.dst.gov.in/scientific-programme/t-d-wti.htm
	Project lists of WTI Programme	http://dst.gov.in/scientific-programme/t-d-wti.htm

9. CHINA

9.1 Context and RDTI[1]

China is the third largest country (9,596,961 km²) in the world in terms of area but it is the world's largest based on population with more than 1.3 billion of inhabitants. China's geography is highly diverse, with hills, plains, and river deltas in the east and deserts, high plateaus and mountains in the west. China's geography causes an uneven population distribution: 94% live in the eastern third of the country. The coastal regions are the most economically developed –acting as a magnet for millions of migrants from the poor rural interior. Climate is equally varied, ranging from tropical in the south to subartic in north-eastern China. Precipitation is almost invariably concentrated in the warmer months, though annual totals range from less than 20 mm in northwestern Qinghai and the Turpan Depression of Xinjiang to easily exceeding 2,000 mm in Guangdong, Guangxi, and Hainan. China has rich natural resources being one of a few countries in the world where mineral deposits are rich and varieties are fairly complete. The main natural resource are coal, iron ore, petroleum, natural gas, mercury, tin, tungsten, antimony, manganese, molybdenum, vanadium, magnetite, aluminum, lead, zinc, uranium. China's economy has undergone a tremendous change since 1978. In 2008 China was the world's second largest economy. Its GDP is 8,227 trillion of USD and its gross national income per capita of 6,091 USD ranked 90th in the world.

Over the past 20 years, investments in research & development have more than doubled in percentage, rising from 0.73 of GDP in 1991 to 1.77% in 2011. The plan of the Chinese government is to reach 2.5% —today's average for the countries of the European Union—by 2020. Between 2000 and 2010, the volume of R&D expanded 6.6 times reaching RMB 700 billion in 2010 (84 billion €). Patent applications are growing at 20% per year and totaled 500,000 in 2010. China counts close to 700 high-tech "incubators", which provide financing, facilities and advice for business start-ups.

The first Cooperation Agreement between the European Commission and China was signed in 1998 and since then cooperation has kept on growing very dynamically as shown by the Chinese increased participation in the activities of research projects funded by FP5, FP6 and FP7. In 2005 the Chinese Ministry of Science and Technology (MOST) and EU launched the project "Multi-stakeholder Platform for ASEM S&T cooperation on Sustainable Water Use"". In 2009 ASEM Forum on Water Resources Management was held in Changsha, Hunan Province in China where the ASEM Water Resources Research & Development Center was founded to establish a long-term partnership among Asia-Europe water resources research institutes.

In September 2012 a Joint Declaration to bring EU-China Innovation Cooperation Dialogue to a higher level was signed in occasion of the 15th EU-China Summit. The first EU-China flagship initiative for research and innovation was launched at the 16th EU-China Summit in November 2013. This new initiative will ensure concrete, substantial and balanced joint research and innovation cooperation activities on selected priorities of common interest. On March 14, 2012 China and Europe have agreed to establish a platform for dialogue, joint research and private sector on better management of water resources (www.cewp.org).

[1]Information based mainly on information sent by Leihua Dong, assistant to prof. Peng Qidong of IWHR, on documentation available from the *EU-China policy dialogues support facility* of the China-Europe Water Platform, on the report "Science, Research and Innovation between EU, MS and China", the consultation of the websites of the following institutions: European Union, World Bank, State Council of the People's Republic of China, Ministry of Science and Technology, Ministry of Water Resources, Chinese Academy of Sciences, China Institute of Water Resources and Hydropower Research, the Institute of Geographic Sciences and Natural Resources Research, Research Center for Eco-Environmental Sciences, the main Chinese Universities and the report "BUILDING BRICKS" of Thomson Reuters

9.2 Water challenges

China holds 6% of the world's total water resources but because of its large population water availability per capita is only160 m^3.

China's average total rainfall in a year amounts to 6 trillion m^3; the total runoff of its rivers is 2.7 trillion m^3; and its total water resources reach 2.8 trillion m^3, to rank sixth in the world, after Brazil, Russia, Canada , the United States and Indonesia. China has the world's largest hydropower potential, as theoretical hydropower resources provided by the county's rivers amount to 676 kW, of which 378 M kW can be exploited for power generation, ranking first in the world. The distribution of such hydropower resources is uneven: they are concentrated in southwest China.

China has 50,000 rivers, each with a catchment area greater than 100 km^2. The majority of rivers flow from West (from Tibet) to East into the Pacific Ocean. The longest at 6,300 km is the Chang Jiang (Yangtze River) which is the third longest river in the world after the Amazon and the Nile. The second longest at 5,460 km is the Huang He (Yellow River). The Heilongjiang (Black Dragon River) flows for 3,101 km in northeast China. The longest river in South China is Zhujiang (Pearl River) which is 2,214 km long.

Because of its large and diverse geography, China has a wide spectrum of terrains and climate zones. While southern and eastern China enjoys abundant rainfall, the northern and western regions of the country receive very little. This weather pattern can lead to unfortunate and seemingly contradictory effects, with some provinces battling floods while others are suffering from months-long droughts. In the total of 663 cities in China, there are more than 400 cities suffer from water shortage problem, and above 110 cities are in sever water shortage. It is estimated that the daily water shortage of all cities in China is about 16 million m^3; the affected industrial production value due to water shortage may reach to more than 200 billion in a year; the affected urban population is about 40 M inhabitants. Besides the disparity in water supply between the north and south, China's water crisis has a second factor: pollution. Even in water-rich areas of China, pollution is decreasing the supply of clean, usable water. According to estimates, a full 70% of China's rivers and lakes are currently contaminated, half of China's cities have groundwater that is significantly polluted, and one-third of China's landmass is affected by acid rain. Over pumping and contamination of groundwater is another water challenge forcing cities and business to dig deeper to find clean, adequate supplies. Since 1990, the average loss resulting from floods has amounted to about 1.5% of GDP of the same period, and the average economic loss resulting from droughts has been over 1% of GDP of the same period.

9.3 Institutional framework

Research

Science, technology and innovation are at the center of the economic development strategies of China which having a population of more than 1.3 billion inhabitants represents the second largest economy in the world. Environmental sustainability of renewable biological resources such as water is one of the main social challenges to face in order to reduce high inequality in the social and economic growth of China and to improve the quality of life of its citizens. In fact the report to the Eighteenth National Congress of the Communist Party of China on 8 November 2012 states that "*China must give high priority to making ecological progress and incorporate it into all aspects and the whole process of advancing economic, political, cultural, and social progress, work hard to build a beautiful country, and achieve lasting and sustainable development of the Chinese nation*".

The main player in RDI is the Ministry for Science and Technology (MOST) who is responsible for drafting the national basic research programme, the national high-tech R&D programme and the S&T enabling programme. The national high-tech R&D program, namely the 823 Programme, has boosted China's overall high-tech development, R&D capacity, socio-economic growth and national security. One of its goals is to achieve breakthroughs in key technologies for environmental protection, resources and energy development. In April 2011 the Chinese State council approved continued implementation of this program in the 10th Five-Year Plan organizing 12 mega-projects with a total investment of RMB 20 billion (2.4 billion USD). One of the affiliated agencies is the Chinese Academy of Science and Technology Development (CASTED) created to improve the capability of macro-management and decision making.

A very relevant role in RDI at national and international level is played by the Chinese Academy of Science (CAS) which was founded in Beijing on 1 November 1949, a month after the founding of the People's Republic of China and mandated to be the key force of the new China's scientific research system. CAS has 12 Branch Offices, 117 Iinstitutes with legal entity, more than 100 national key laboratories and national engineering research centers and about 1,000 field stations throughout the country.

Water

In 2010, China's Communist Party Central Committee and State Council promulgated a "**Three Red Lines**" policy intended to establish clear and binding limits on water quantity usage, efficiency, and quality. In early 2012, the State Council announced that the "**Three Red Lines**" policy would limit total national water consumption to less than 700 billion m^3 per year, amounting to approximately three-quarters of China's total annual exploitable freshwater resources. Specifying the control indicators of the "**Three Red Lines**", China will control water use efficiency. Water consumption per RMB 10,000 industrial value must be below 65 m^3 by 2020, and 40 m^3 by 2030; coefficient of effective farmland irrigation water use must be higher than 0.55 by 2020, and 0.6 by 2030. In addition, the policy attempts to increase irrigation use efficiency to 60% by 2030.

The main policy objectives in the water sector in China are:

- To accelerate transformation of the water use pattern under the guidance of the sustainable development concept;
- To develop and utilize water resources in a scientific and rational manner centering around total quantity control;
- To construct a water-saving society on all fronts with a view to improving water use efficiency;
- To reinforce protection and restoration of water resources with management of water function areas as the vehicle;
- To strengthen the performance assessment and supervision of the local governments as the major accountable parties in water management;
- To build up capacity for allocation, regulation and control of water resources by way of connecting water systems of rivers and lakes, to improve water resources management based on better monitoring systems; and
- To use reforms and innovation as driving forces for improvement of water resources management systems and mechanisms.

In order to cope better with these objectives the Ministry of Water Resources shifted from a traditional approach to a modernized and sustainable water resources management way. An effective management system has been created for rational development of water, highly-efficient utilization,

optimized allocation, and all-round conservation and protection. Laws and regulations such as Water Law and Water Pollution Prevention and Control Law are the legal base for water resources management. Comprehensive plans have been made. Favorable financial and taxation policies for the conservation and protection of water resources have been preliminarily established. Backbone water projects are constructed for optimizing water resources allocation and protection. The approach of integrated river basin management has been highlighted for keeping a balance between water needs upstream and downstream and demand of environmental flow.

The **Research Center for Eco-Environmental Sciences** (RCEES) of the Chinese Academy of Sciences (CAS) is the first comprehensive research institution engaged in research on eco-environmental science and technology, water included. The **China Institute of Water Resources and Hydropower Research** (IWHR) of CAS is the main institution devoted to water research carrying out specified programmes and projects on IWRM topics. Also the **Institute of Geographic Sciences and Natural Resources Research** of AKA focus on water resources and water cycle.

9.4 China, water use and market overview

Water use in China by sector (2003)[1]	%	% in 2030[4]
Agriculture	65	51
Industry	22	32
Domestic	13	17
Total	100	100

It is expected that water in agriculture will decrease in the coming years which means more efficient use of water in agriculture. Urban population will expand from 572 M in 2005 till 920 M in 2025. Over the past 15 years two Chine megacities of more than 10 M inhabitants have merged. On current trends six more such cities will emerge over the next 20 years. At the same time China will industrialize further[2].

China faces many water challenges, such as water pollution of surface water due to untreated waste water and waste disposal, and groundwater depletion and inefficient use of water in agriculture. The industrial consumers of water are steel, paper, chemicals, textile and food and beverage.

Waste water treatment is lagging behind compared with the economic growth. Sea water desalination is rather new in China but is expected to grow in the coming years.

Water reuse is successfully introduced in Beijing. Beijing has ambitious plans to upgrade all the waste water treatment plants to water reuse plants.

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1 SOURCE: HTTP://WWW.FNU.ZMAW.DE/FILEADMIN/FNU-FILES/

2 SOURCE: 2030 WATER RESOURCES GROUP

Market forecast 2010 China[1]	
Total water market: 47867 M USD	
Sector	Share (%)
Utilities	87.9
Industrial water	4.6
Bottled water	3.5
Point of use equipment	2.5
Irrigation equipment	1.5

Market forecast[1]			
Sector (CAPEX)	Time frame	Value (M USD)	Increase / decrease (%)
Drinking water[2]	2007 – 2010	12500 - 32500	+ 160
Waste water networks	2007 - 2016	4000 - 9000	+ 125
Waste water treatment plants	2007 - 2016	5000 - 18000	+ 260
Industrial expenditure	2007 - 2016	1300 - 2000	+ 53
Water re use	2007 - 2016	500 - 980	+ 96
Desalination	2009 - 2016	580 - 900	+ 55

1 SOURCE – GLOBAL WATER MARKET 2011 FROM THE PUBLISHERS OF GLOBAL WATER INTELLIGENCE.

2 THIS INCLUDES WATER RESOURCES (INCLUDING DESALINATION), WATER DISTRIBUTION NETWORKS (NEW BUILD AND

REHABILITATION AND DRINKING WATER TREATMENT PLANTS (NEW BUILD AND REHABILITATION)

9.5 analyses scientific publications

Population: 1,350 M inhabitants GDP: 6,101 G €

Research Question	Publications			Publications Respect Europe (%)		
	Number	Per M inhab.	Per G € GDP	Number	Per M inhab.	Per G € GDP
Q1: Ecosystems	7,082	5	1	24	11	41
Q2: Citizens	9,541	7	1	28	13	**49**
Q3: Industry	29,007	21	3	23	11	40
Q4: Bioeconomy	3,556	3	0.4	25	11	43
Q5: Gap	5,110	4	1	26	12	45
All	36,802	27	4	**28**	13	**49**

The publications produced in China in the field of water represent 28% of the European publications. When the number of publications is standardized per GDP, Europe leads (China is 49% of Europe). When analyzing Chinese S&T production in the light of the five research questions expressed in the Water JPI SRIA, the main strengths are in the **Citizens** area. However, all five research questions are quite similar in intensity respect to Europe.

During the studied 15-year period, China has multiplied its publications by 18. This is the highest increase rate of the analyzed countries, representing 792% of the European increase for the same period. China publishes with 111 countries, 31 of which are EU Member States and Associated Countries. The International Cooperation Index is 29% and the European Cooperation Index is 8%.

Who

is publishing with China?

In the world	%	In Europe (MS+AC)	%
USA	8.8	GERMANY	1.6
EU (MS+AC)	8.1	UK	1.4
AUSTRALIA	2.3	FRANCE	0.8
CANADA	2.2	NETHERLANDS	0.7
TAIWAN	1.0	SWEDEN	0.4

Who

is funding this research?

Funding Agencies	%*
NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA, NSFC	51.0
MINISTRY OF SCIENCE TECHNOLOGY OF CHINA	23.4
CHINESE ACADEMY OF SCIENCE, CAS	8.2
MINISTRY OF EDUCATION OF CHINA	3.5
FUNDAMENTAL RESEARCH FUNDS FOR THE CENTRAL UNIVERSITIES	2.9

Which

Institutes are doing the work?

Organizations	%
CHINESE ACADEMY OF SCIENCE	24.4
CHINA UNIV*	6.2
HONG KONG UNIV*	5.2
NANJING UNIV*	4.6
BEIJING UNIV*	4.5

*Sum of several Universities with the same main name.

Analysis per topic:

Who

	Organization	%	Author	%
Q1	CHINESE ACADEMY OF SCIENCE	38.2	ZHANG J	1.2
	BEIJING NORMAL UNIV	4.4	LI Y	1.1
	CHINA AGR UNIV	3.3	LI J	1.0
	HOHAI UNIV	3.1	YANG ZF	1.0
	LANZHOU UNIV	2.8	WANG Y	1.0
Q2	CHINESE ACADEMY OF SCIENCE	28.3	ZHANG Y	1.7
	HARBIN INST TECHNOL	3.2	WANG Y	1.7
	TONGJI UNIV	2.4	ZHANG J	1.3
	NANJING UNIV	2.3	LI J	1.2
	TSINGHUA UNIV	2.1	LI Y	1.1
Q3	CHINESE ACADEMY OF SCIENCE	19.6	ZHANG Y	1.3
	ZHEJIANG UNIV	3.6	LI Y	1.3
	PEKING UNIV	2.4	ZHANG J	1.2
	NANJING UNIV	2.3	WANG Y	1.2
	TSINGHUA UNIV	2.2	LI J	1.1
Q4	CHINESE ACADEMY OF SCIENCE	31.3	KANG SZ	2.4
	CHINA AGR UNIV	9.1	ZHANG JH	1.8
	BEIJING NORMAL UNIV	4.0	ZHANG L	1.4
	WUHAN UNIV	3.6	KANG YH	1.3
	HOHAI UNIV	3.3	LI J	1.2
Q5	CHINESE ACADEMY OF SCIENCE	25.7	XIA J	1.2
	BEIJING NORMAL UNIV	4.7	ZHANG J	1.1
	HOHAI UNIV	4.6	CHEN X	1.1
	CHINA AGR UNIV	3.5	ZHANG Y	1.0
	WUHAN UNIV	3.2	LI Y	1.0

9.6 Major RDI programmes

According to the information provided during an event of the China- Europe Water Platform, China's water sector programme for the period 2013-2020 is worth from 60 to 100 billion €. Investments granted by the central Chinese government and local authorities in the water sector have increased considerably in the 2010 and 2011 in order to implement the very ambitious strategy on water resource management established in a policy document on accelerating reform and development of water conservancy dated 2011 and in another policy document on implementing the most stringent water resources management system dated 2012. These headline policies are augmented by increased investment, including 1.8 trillion RMB in 2011-2015, primarily for irrigation infrastructure improvements, rural clean water delivery, and reservoir enhancements. Since the 10th Five-Year Plan, approximately two billion USD has been borrowed from international financial organizations, namely the World Bank and the Asian Development Bank, and used for water projects construction.

In China, the national RDI programmes agencies related to water challenges and the Water JPI SRIA are funded by the State Council of the People's Republic of China, i.e. the Central Government, according to main water problems which are:

- Conserving and Protecting Water Resources
- Flood Control and Drought Relief
- Safe Drinking Water
- Soil and Water Conservation
- Reservoir Safety

South-to-North Water Diversion Project

The project involves drawing water from southern rivers and supplying it to the dry north. This massive scheme has already taken 50 years from conception to commencement and is expected to take almost as long to construct. Planned for completion in 2050, it will eventually divert 44.8 billion m^3 of water annually to the population centers of the drier north. When finished, the work will link China's four main rivers –the Yangtze, Yellow River, Huaihe and Haihe– and requires the construction of three diversion routes, stretching south-to-north across the eastern, central and western parts of the country. The complete project is expected to cost $62billion – more than twice as much as the country's controversial Three Gorges Dam.

The Ma'anshan Cihu River Basin Improvement Project

This project includes rehabilitation works along the Cihu River including slope protection, embankment strengthening, construction and rehabilitation of flood control structures, pumping stations and service roads, ecological rehabilitation and greening. It will also restore the natural storm drainage function of tributaries and canals, develop a watershed scale water quality monitoring program, and compile an environmental protection reference document setting forth prevention and mitigation measures for future contamination of water from mining activities and ecological restoration of mined lands. The total project cost is estimated to be 210.35 M USD, with the IBRD loan of 100 M USD to finance 47% and the counterpart financing coming from the municipal budget.

The Hai Basin Integrated Water and Environment Project

Safe drinking water is crucial for people and directly linked to the livelihood of human beings. Providing safe drinking water is the first priority task of the Ministry of Water Resources. During the "11th Five-Year Plan" period, the Central Government is planned to invest 32 billion Yuan for safe drinking projects, which is three times as much of the "10th Five-Year Plan" period. But implementing the Safe Drinking Water Program should not rely solely on the financial resources from the Central Government, it is important to establish a stable investment growth mechanism. This project effectively promoted an integrated approach to water resource management and pollution control in the Hai Basin in northern China. The project contributed to the restoration and protection of the marine environment, ecosystem and biodiversity of the Bohai Sea. Over 20 M people benefited from reduced water pollution.

The North China Plain Water Conservation Project

This project is aimed to enhance beneficial use of water resources, agriculture production capacity, and farmer incomes by: increasing the value of agriculture production per unit of water consumed through increasing yields and reducing non-beneficial water losses; and establishing mechanisms for sustainable use and management of water resources in irrigated areas. The project supported integrated improvements to over 100,000 hectares of irrigated land and 257,000 farm households in the provinces of Hebei and Liaoning and in the municipalities of Beijing and Qingdao. The project had four components: (a) irrigation and drainage works and on-farm systems, including canal lining, low-pressure pipes, drains, wells, surface irrigation improvements, sprinklers, and micro-irrigation systems; (b) agriculture support and services, including land levelling, non-tillage in the dry season, deep plowing in the rainy season, soil fertility improvements, organic and plastic mulching, cropping pattern adjustments, seed improvements, balanced fertilization, and improvements to planting and cultivation techniques; (c) forestry and environmental monitoring of the project's impact on soil and water; and (d) institutional development and capacity building for water and soil conservation.

The Risk Mitigation and Strengthening of Endangered Reservoirs in Shandong Province Project

These reservoirs have played an important role in flood control, irrigation, water supply, power generation and improvement of ecological environment, and worked as key infrastructures for national economic development. However, most of these reservoirs were constructed during the period of 1950s-1970s, at low level of flood control standard and in poor quality. Now the reservoirs are ageing and lack of proper maintenance due to the shortage of funds. Nearly 40% of the reservoirs turn into hazardous. These hazard reservoirs pose potential threat to people's lives and property downstream. A 29.8 M USD loan for this project had been approved by ADB's Board of Directors. The loan rehabilitated nine ageing dams and hoped to set the standard for efficient, safe and cost-effective reservoir operation and management nationwide. This initiative will reduce the risk of reservoir failure as well as protect lives, property and livelihoods downstream where poverty levels are high. It will also provide more water for agriculture and household use, improve the quality of reservoir releases, preserve water quality and improve groundwater resources.

Research Project of Long-Distance Monitoring Technology of Underground Water Source

Based on SDJ computer monitoring system, the project is featured with exclusive intelligent terminal combining collection, storage, communication and texting, and capable of source well long-distance monitoring, communication and long-distance on-line modification. The research results have been piloted in Tianjin Municipality and Inner Mongolia and Liaoning Province.

Research Results of Project on Hydrological Method Innovation System Building in China

This project was jointly undertaken by IWHR, Tsinghua University, Sichuan University and Hohai University, and focused on research of China's hydrological method evolvement pattern, research system, development strategy and hydrological uncertainty method.

Technology for Water Pollution and Algae Bloom Control of Three Gorges Reservoir

Focusing on the water environment problem of the Three Gorges reservoir with the aim of guaranteeing the water quality security this project studies the major scientific issues concerning the water environment evolution mechanism at the early stage of impoundment and the algae bloom mechanism for reservoir detention area, establishing a series of technical systems respectively for integrated reservoir water environment management, water pollution control and treatment, basin-wide water environment improvement and water quality security.

Clean Energy and Efficient Irrigation in Hilly Areas

The core technological achievements of the irrigation system promoted by this project include wind force pneumatic water lift pump and high-homogeneity low pressure drip irrigation system, combining wind-powered water lift and storage. The system also features four efficient irrigation techniques of drip, micro-sprinkling, sprinkling and pipeline irrigations. The research team has also compiled a guidebook for the development, operation and management of the irrigation system.

China institute of water resources and hydropower research website:

The China Institute of Water Resources and Hydropower Research (IWHR) was established in 1958 by merging three organizations, namely, the Water Resources Research Institute under the Ministry of Water Resources, the Hydropower Research Institute under the Ministry of Electric Power Industry, and the Institute of Hydraulic.

Research under the Chinese Academy of Sciences. Disbanded in 1969 and reorganized in February 1978, now the Institute is affiliated with the Ministry of Water Resources. It was renamed as the China Institute of Water Resources and Hydropower Research in 1994. The Institute has a long history and its founding can be traced back to 1933. Since the establishment in 1958, IWHR has now developed into a research center of water resources and hydropower in China. It is responsible for the research tasks encountered in major hydro projects, state five-year plan key programs of science and major programs funded by the Ministry of Water Resources, the Ministry of Science and Technology, as well as the National Natural Science Foundation of China. The annual revenue of the Institute is growing rapidly, up to 0.356 billion Yuan in 2004.

RESEARCH CENTER FOR ECO-ENVIRONMENTAL SCIENCES

The former Institute of Environmental Chemistry of Chinese Academy of Sciences founded was amalgamated with Research Center of Ecology of CAS in 1986 and was reorganized into Research Center for Eco-Environmental Sciences of Chinese Academy of Sciences (RCEES). Currently there are 377 staff members in RCEES, including 7 academicians, 60 research professors, 84 associate professors, 109 assistant professors and 47 junior researchers or administrators working in various areas. There are 8 research Departments or Laboratories including three state key laboratories (State Key Laboratory of Environmental Chemistry and Ecotoxicology, State Key Laboratory of Aquatic Chemistry, State Key Laboratory of Urban and Regional Ecology), 5 Departments for administration or management and other sections. The Department of Water Pollution Control Technology (DWPCT) has successfully accomplished a large number of research projects supported

by the Chinese Central Government, National Natural Science Foundation of China, Chinese Academy of Sciences, and local governments. Its academic achievements include 13 prizes, 150 research papers, and 100 patents applied and authorized.

DWPCT is focusing on four research areas:

1. Research and application of pollutant conversion mechanism and key technology for water pollution control.

Based on the systematic research efforts on the transfer and conversion mechanisms of pollutants, innovative technologies for water pollution control and wastewater reclamation are developed. With a variety of application technologies such as the integrated oxidation ditch with vertical circle, membrane bioreactor with gravity drainage, integrated biological nitrogen and phosphorus removal, membrane-aerated biofilm reactor, rural wastewater treatment, concentrated and refractory organic wastewater treatment, and etc. These technologies can lower energy consumption and reduce pollutants discharge, thus have wide applications in the treatment of municipal, rural and industrial wastewaters as well as the reuse of reclaimed wastewater. Demonstration engineering projects have been correspondingly constructed.

2. Research and application of membrane separation science and technology.

Relevant theories and technologies of membrane separation membrane separation for municipal wastewater treatment and liquid clarification were utilized. An efficient vacuum cleaning method for membrane was invented.

3. Research and application of VOCs and odorous gases purifying mechanism and technology.

The major research areas cover the transfer and conversion mechanisms of pollutants in gas, characterization of microorganisms in bioreactor, and new technology development for odorous pollutants removal. Bio-deodorization and integrated bio-chemical technologies have been successfully applied in the deodorization of municipal wastewater treatment plants and waste landfill sites.

4. Research of excess sludge reduction and reclamation.

Sludge composition, sludge substrate conversion and microbial characteristics for sludge treatment have been systematically investigated. Current research areas center on sludge reduction with microwave and compost technologies and sludge reclamation to produce fermentative hydrogen gas and biodegradable plastics (polyhydroxyalkonates, PHA).

INSTITUTE OF GEOGRAPHIC SCIENCES AND NATURAL RESOURCES RESARCH

The Institute of Geographic Sciences and Natural Resources Research (IGSNRR) of the Chinese Academy of Sciences (CAS) was established in 1999 through the merger of the former Institute of Geography (IOG), founded in 1940, and the former Commission for the Integrated Survey of Natural Resources (CISNAR), founded in 1956. IGSNRR is a multidisciplinary research institute focusing, among other things, on physical geography and global change, human geography and regional development, natural resources and the environment, geographical information systems and surface simulation, the terrestrial water cycle and water resources, ecosystem network observation and modeling, and Chinese agricultural policy. Through research in these domains, the institute aims to solve major natural resource and environmental problems related to national sustainable development and improve its own innovative capacity at the same time. The institute is home to the

State Key Laboratory of Resources and Environmental Information Systems; the CAS Key Laboratory of Water Cycle and Related Land Surface Processes; the CAS Key Laboratory of Ecosystem Network Observation and Modeling; and the CAS Key Laboratory of Sustainable Regional Development and Modeling. It also supports two national field observation stations: the ChinaFLUX observation station at Yucheng, Shandong province and the Lhasa Plateau Ecological Research Station.

Policy support and Social capital Play Significant Role in Improving Farmers' Adaptive Capacity against Drought in China

Based on a large-scale household and village survey conducted in six provinces nationwide, it was found that 86% of rural households have taken adaptive measures to protect crop production against drought, most of which are non-engineering measures. In the case of non-engineering measures, changing agricultural production inputs and adjusting seeding or harvesting dates are two popular options.

The study has been published in Global Environmental Change (Chen, H. et al., 2013) "Policy support, social capital and farmers". Adaptation to drought in China, Global Environmental Change)

Water Input and Water Evaporation during Sewage Sludge Bio-drying

The purification of domestic wastewater produces large quantities of sewage sludge, and the urbanization and industrialization in China has resulted in a dramatic increase in the volume of wastewater and sewage sludge. The moisture content of dewatered sewage sludge is about 80%, which causes a series of problems in terms of sludge treatment and disposal. Therefore, reducing sludge moisture is important to the reduction of sludge volume and quantity. Sewage sludge bio-drying is an economical and energy-saving method of simplifying thermophilic aerobic fermentation that utilizes the biological energy produced by microbial fermentation to activate bound water and evaporate moisture, resulting in rapid reduction of the moisture in the bio-drying material. The water mass balance of sewage sludge bio-drying pile indicates that variations in pile moisture are associated with water input and water output. Water input includes: (1) water generation, which is water produced by microbial metabolism during organic matter decomposition; and (2) aeration water input, which is moisture added to the pile during forced aeration. Water output includes the water evaporated from the bio-drying material and the leachate produced during bio-drying.

NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA

The National Natural Science Foundation of China (NSFC) was established under the ratification of the State Council on February 14, 1986. NSFC has gradually established its funding system focusing on the three categories of programs of research promotion, talent fostering and infrastructure construction for basic research. The category of research promotion has been developed with a comprehensive funding scope ranging from

the General Program, Key Program, Major Program, Major Research Plan, Joint Funds to International Joint Research Program. The category of talent fostering has been provided with the integrative funding for the Fund for Talent Training in Basic Science, Young Scientists Fund, Regional Science Fund, and National Science Fund for Distinguished Young Scholars and Creative Research Groups. The category of infrastructure construction has been improved with the Special Funds for Basic Research Instruments, International Cooperation and Exchange, Public Understanding of Science, etc. Along with the increasing investment to basic research by the government, the budget for the National Natural Science Fund has been increased from 80 M RMB in 1986 to 10.4 billion

RMB in 2010 which has significantly improved the funding environment for basic research and the funding for individual projects has been gradually raised.

The strategy for international and regional cooperation and exchange has been formulated during the 12th NSFC Five-Year plan period to encourage researchers to conduct joint research activities with top scientists around the world. To this end, NSFC strives to create a favorable environment regarding cooperative channels, funding and operational mechanisms to facilitate the participation of Chinese scientists in the international cooperation and exchange. Up to now, NSFC has signed cooperative agreements and memoranda of understanding with 68 science funding organizations and national research institutions in 37 countries and regions and raised its budget for international cooperation and exchange from 3 M Yuan in 1987 to 82 M Yuan at present. It has gradually formed a rather complete funding scenario which includes four project categories and three special funds: joint research projects, international (regional) academic conferences held abroad, international academic conferences held in China, major joint research projects, fund for Chinese scholars abroad returning for short-period of work or lecture (including "two bases" projects), joint fund between NSFC and the Research Grant Council of Hong Kong and fund for international cooperation and exchange of State Key Laboratories.

According to the actual needs of scientists and researchers in China, 4 categories of international (regional) cooperation and exchange programs have been established, i.e., International/Regional Joint Research Program, International/Regional Cooperation and Exchange Program, International (Regional) Academic Conferences, and Research Fund for International Young Scientists.

In 2012, all together 106 projects under the Major International (Regional) Joint Research Program were funded with a total funding of 300 M Yuan, i.e., an average funding of 2.83 M Yuan per project, which means an increase in number of projects funded by 15.2% and an increase in funding scale by 17.6% respectively over the year 2011. In 2013 the average funding has been increased to 3 M Yuan per project and each project usually lasts for 5 years.

Joint Research Program within Bilateral Agreements/MOUs

Joint research program within bilateral agreements/MoUs includes bilateral or multilateral joint research projects funded by NSFC and its international partners under the framework of cooperation agreements /MoUs signed among them in hope of supporting Chinese researchers and their collaborators abroad to carry out their research in basic sciences. As eligibility for application, priority funding areas, application deadlines, reporting requirements, applicants are referred to Regulations on the management of NSFC International (Regional) Joint Research Programs and the calls for proposals launched on NSFC website.

There are several bi-lateral research agreements between the National Natural Science Foundation of China and many international scientific organizations and research institutions in European countries. In particular, NSFC has signed agreements and MoUs on scientific cooperation with 30 science foundations or research councils in 15 countries in Europe. Activities to be funded include short-term exchange visits, bilateral academic workshops and joint research.

United Kingdom

Royal Society

NSFC and the Royal Society of UK (RS) provide support up to 20 joint projects with a period of 2 years. NSFC provides international travel costs for Chinese scientists and local costs for British scientists in China. RS provides at most 6,000 pounds for each project, covering international travel

costs for British scientists to China and local costs for Chinese scientists in UK. In the midyear of 2013, NSFC and RS have announced their call for proposal simultaneously in both countries. Projects approved will start on April 1, 2014 and end on March 31, 2016.

Royal Society of Edinburgh NSFC and the Royal Society of Edinburgh (RSE) provide joint funding for 2-year joint research projects between scientists from China and Scottish region in areas of common cooperation and the number of projects to be approved each year are decided by both sides through negotiation. NSFC provides international travel costs for Chinese scientists to UK and local costs for British scientists in China. RSE provides at most 6,000 pounds for each project, according to the MoU signed between NSFC and RSE. In specific areas, funding covers the international travel costs for British scientists to China and local costs for Chinese scientists in UK. NSFC and RSE have announced their call for proposal simultaneously in both countries in the midyear of 2013. Projects approved start on Jan. 1, 2014 and end on Dec. 31, 2015.

UK Research Councils (1) Workshops - NSFC will continue to cooperate with UK Research Councils such as EPSRC, BBSRC, NERC and MRC to fund small-scaled bilateral workshops co-organized by Chinese and British scientists. International (Regional) Cooperation and Exchange.

(2) Joint Research Program - NSFC and Research Councils in UK (RCUK) support substantial collaborations between scientists of both countries in areas of common interest, in consideration of the existing cooperation between scientists.

Germany

According to the agreement on cooperation between NSFC and Deutsche Forschung Gemeinschaft, Chinese and German research teams are encouraged to conduct major International (Regional) Cooperation and Exchange interdisciplinary joint research projects. Researchers from 3-5 Research Institutions on each side are encouraged to combine their research capacity and, based on mutual agreement on research topics and objectives, submit joint applications to NSFC and DFG respectively for long-term bilateral collaboration, interdisciplinary research and training of young scientists.

France

French National Center for Scientific Research NSFC and French National Center for Scientific Research (CNRS) support exchange of visits between Chinese and French scientists. NSFC funds international travel costs for Chinese scientists to France and the local costs for French scientists in China, and CNRS funds the local expenses for Chinese scientists in France and international travel costs for French scientists to China.

The French National Research Agency

According to the MoU signed between NSFC and The French National Research Agency (ANR), both sides encourage substantial cooperation in areas of common interest between scientists and research groups of both countries.

Finland

The Academy of Finland (AKA)

According to the agreement of scientific cooperation between NSFC and the Academy of Finland (AKA), both sides provides necessary support for Exchange Projects, Bilateral Workshops, and Joint Research Programmes.

Austria

The Austrian Science Fund (FWF)

According to the agreement of scientific cooperation between NSFC and The Austrian Science Fund (FWF), both sides support academic exchanges and joint research in areas of common interest. Each year, the both sides will decide the collaborative areas and the numbers of projects which will be funded through discussion, make simultaneous call for proposals, and accept proposals from scientists of their respective countries. Funding for the projects includes research and international exchange costs.

The Netherlands

The Netherlands Organization for Scientific Research (NWO)

NSFC and the Netherlands Organization for Scientific Research (now) encourage scientists or research teams of both countries to carry out substantial joint research in areas of common interest. Funding for the projects includes research expenditure and international exchange costs.

9.7 Connections between Water JPI SRIA and the RDI programmes and policies of the country

SRIA Questions	Rate* (1 to 6)	Brief motivation of the rating
Sustainable ecosystems	6	China must give high priority to make ecological progress and incorporate it into all aspects and the whole process of advancing economic, political, cultural, and social progress.
Developing safe water systems for the citizens	5	China restricts pollutants in water function areas. Water quality standards of the main water functional zones in rivers and lakes must reach 80% by 2020, and 95% by 2030.
Promoting competitiveness in the water industry	3	In 2012 the Chinese government released its policy document on implementing the most stringent water resources management system to support the lasting and sustainable development of the country.
Implementing a water-wise bio-based economy;	6	Specifying the control indicators of the Three Red Lines" China will control water use efficiency. Water consumption per RMB 10,000 industrial value must be below 65 m^3 by 2020, and 40 m^3 by 2030. Coefficient of effective farmland irrigation water use must be higher than 0.55 by 2020, and 0.6 by 2030.
Closing the water cycle gap	6	Specifying the control indicators of the "Three Red Lines", China will control the development and utilization of water resources. The total quantity of water consumption nationwide must be below 6700 108 m^3 by 2020, and 7000 108 m^3 by 2030. Priorities are: to accelerate transformation of the water use pattern under the guidance of the sustainable development concept; to develop and utilize water resources in a scientific and rational manner centering around total quantity control; to construct a water-saving society on all fronts with a view to improving water use efficiency; to reinforce protection and restoration of water resources with management of water function areas as the vehicle. Local governments are the major accountable parties to strengthen performance assessment and supervision, build up their capacity for allocation, regulation and control of water resources by way of connecting water systems of rivers and lakes, improve water resources management based on better monitoring systems. Reforms and innovation are the driving force for improvement of water resources management systems and mechanisms.

*1 = weak connection with Water JPI SRIA

6 = strong connection with Water JPI SRIA

9.8 Acronyms of CHINESE Institutions and reference documents

Acronym	Institution Name	Website
CAS	Chinese Academy of Sciences	http://english.cas.cn/
CASTED	Chinese Academy of Science and Technology for Development	http://www.casted.org.cn/web/index.php?ChannelID=64
NSFC	National Natural Science Foundation of China	http://en.ustc.edu.cn/dictionary/201105/t20110509_111378.html
CAE	Chinese Academy of Engineering	http://www.caets.org/cms/7664/8100.aspx
MOST	Ministry of Science and Technology of the People's Republic of China	http://www.most.gov.cn/eng/
MOE	Ministry of Education of the People's Republic of China	http://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/moe_2792/
MWR	Ministry of Water Resources of the People's Republic of China	http://www.mwr.gov.cn/english/
IWHR	China Institute of Water resources and Hydropower	http://www.iwhr.com/zgskyww/index.html
RCEES	Research Center for Eco-Environmental Sciences	http://english.rcees.cas.cn/
IGSNRR	Institute of Geographic Sciences and Natural Resources Research	http://english.igsnrr.cas.cn/ai/bi/201312/t20131230_115103.html
	Beijing Normal University	http://english.bnu.edu.cn/
	China Agricultural University	http://english.cau.edu.cn/
	Hohai University	http://en.hhu.edu.cn/
	Lanzhou University	http://www.lzu.edu.cn/notice/English/Introduction.htm
	Harbin Institute of Technology	http://en.hit.edu.cn/
	Nanjing University	http://www.nju.edu.cn/html/eng
	Tongji University	http://www.tongji.edu.cn/english/
	Zhejiang University	http://www.zju.edu.cn/english/
	Wuhan University	http://en.whu.edu.cn/
	Hongkong University	http://www.hku.hk/
	ITTN International Technology Transfer Network	http://en.ittn.cn/
	Ministry of Industry and Information Technology of the People's Republic of China	http://www.gov.cn/english/2005-10/02/content_74175.htm

10. SOUTH AFRICA

10.1 Context and RDTI

South Africa is a country that knows importance of science and technology to get over the water scarcity problems. Several official documents (2030 Vision Report, annual reports, strategy reports, etc.) emphasize the importance of enhanced scientific capabilities as a tool to create new jobs and increase the competitiveness of the country on international level.

As a middle income country, it is essential to invest in RDI activities for an efficient and sustainable development model. Besides development of new industries, further utilization of rather traditional industries such as mining industries deemed necessary according to the National Development Plan 2030 (NDP)[1]. The plan offers a long-term perspective with clearly defined goals and milestones to be achieved. The overarching aim of the plan is to set measures to eliminate poverty and reduce inequality. It has many provisions in the fields of capacity building, creating new job opportunities and joint action amongst public entities at different levels for a holistic development process.

10.2 Water challenges

South Africa is a semi-arid, water stressed country, with an average rainfall of about 450 mm per year. Water availability across the country is faced with three major challenges:

- Uneven spatial distribution and seasonality of rainfall (43% of the rainfalls on 13% of the land)

- Relatively low stream flow in rivers most of the time, which limits the proportion of stream flow that can be relied upon for use

- Location of major urban and industrial developments remote from the country's larger watercourses, which necessitates large-scale transfers of water across catchments[2].

Because the South African economy and its urban settlements developed largely in response to mining opportunities, much of the demand for water comes from inland areas, far from major rivers or other sources of water.[3]

Under the National Water Act (NWA), South Africa is divided into 19 Water Management areas (WMAs) for management purposes. These areas reflect the major river basins of the country. Surface water resources are the main source of water supply in South Africa, providing just under 11,000 M m^3/yr.[7] Although groundwater only provides about 10% of this volume, it is extensively utilized, particularly in rural and arid areas. Groundwater quality varies naturally from place to place and is often unsuitable for human consumption or agriculture. Groundwater is also vulnerable to

[1] http://www.npconline.co.za/MediaLib/Downloads/Downloads/Executive%20Summary-NDP%202030%20-%20Our%20future%20-%20make%20it%20work.pdf

[2] http://www.dwa.gov.za/IO/Docs/CMA/CMA%20GB%20Training%20Manuals/gbtrainingmanualchapter1.pdf

[3] http://www.dbsa.org/Research/DPD%20Working%20papers%20documents/DPD%20No12.pdf?AspxAutoDetectCookieSupport=1

local pollution by human activities, particularly in locations with high population densities or concentrations of economic activity.[1]

A recent estimate of the climate change effects on water resources suggests that South Africa may experience a reduction of 10% in average rainfall reducing surface water runoff up to 50-75% by 2025.[2]

Water pollution is a growing problem and can be attributed to municipal pollution, industrial effluent, acid mine drainage and salinization caused by irrigation. The country holds large amounts of platinum group metals, gold, diamond, manganese, coal, iron ore and uranium, thus, improving water infrastructure is also important for exploitation of such sources. Mining activities poses a major threat to local water resources due to drainage from sulfide mineral oxidation (often termed as "acid rock drainage")[3]. South Africa already has qualified researchers working in the field of mine water treatment.[4] Indeed it is claimed that South Africa hold more pilot plants and empirical evidence than anywhere to allow room for researching relation between water resources and mining activities. "Technology and Human Resources for Industry Programme (THRIP)" that is managed by the National Research Foundation (NRF) provide funds to projects addressing technology and process issues in the mining wastewater.[4] [5]

Lowering the costs of water treatment by developing new technologies is amongst the priorities of the country.[6] The research efforts are intensely concentrated on water and waste water treatment systems. Activated sludge, membrane technology and point of use devices are hot spot topics in water RDI. Germany and Sweden have interest in cooperation for water treatment. There are at least three community led sanitation projects funded by Bill and Melinda Gates Foundation.

10.3 Institutional framework

The Department of Water and Environmental Affairs (DWEA) is responsible for water management decisions in conjunction with river basin authorities, catchment organisations and water user associations[5]. In addition, Department of Science and Technology (DST) runs water-related programs. The major Funding Agencies to be analysed in this report are: the Water Research Commission (WRC), the National Research Foundation (NRF).

[1] http://www.esastap.org.za/download/present_seminar_h2020_201301b.pdf

[2] http://www.unepfi.org/fileadmin/publications/water/chief_liquidity1_South_Africa.pdf

[3] http://www.gardguide.com/index.php/Main_Page

[4] http://www.wasteroadmap.co.za/download/report_support_waste_innovation.pdf

[5] http://www.info.gov.za/view/DownloadFileAction?id=94066 (Ten Year Innovation Plan)

[6] bid. 23

10.4 Water use and market overview

Water use in South Africa 2010[1]	
Sector	%
Agriculture	62
Mining, large industry and power generation	27
Public supply	8
Commercial forestry	3

Demand in **South Africa** is projected at 17.7 billion m^3 in 2030 with household demand accounting for 34% of the total. Against this, current supply in South Africa amounts to 15 billion m^3, and it is severely constrained by low rainfall, limited underground aquifers, and reliance on significant water transfers from neighboring countries. South Africa will have to resolve tough trade-offs between agriculture, key industrial activities such as mining and power South Africa is gradually urbanising, with the metropolitan population increasing from 57% in 1994 to 60% in 2008[2].

There is a demand for desalination projects along the coast (at this moment, only 1% of the total water supply is provided by desalination). Water for mining and energy are important sectors as well as water in industry which is one of the fastest growing sectors in South Africa. Water reuse is becoming more and more important in South Africa. Some municipalities sell reclaimed water to communities. Furthermore the Department of Water Affairs is working continuously on improving sanitation and capacity building in rural and urban areas.

[1] Source CSIR

[2] Source: 2030 Water Resources Group

Market forecast 2010 South Africa[1]	
Total water market: 6,142 M USD	
Sector	Share (%)
Utilities	94,4
Industrial water	3.9
Point of use equipment	0.8
Irrigation equipment	0.6
Bottled water	0.3

Market forecast[1]			
Sector (CAPEX)	Time frame	Value (Million USD)	Increase / decrease (%)
Drinking water [2]	2007 – 2010	1250 - 1900	+ 52
Drinking Water[2]	2010 – 2016	1900 – 1600	16
Waste water networks	2007 - 2016	450 - 750	+ 66
Waste water treatment plants	2007 - 2016	300 - 600	+ 100
Industrial expenditure	2007 - 2016	150 - 190	+ 26

[1] Source – Global Water Market 2011 from the publishers of Global Water Intelligence

[2] This includes water resources (including desalination), water distribution networks (new build and rehabilitation and drinking water treatment plants (new build and rehabilitation)

10.5 Analyses of scientific publications

Population: 53 M inhabitants GDP: 280 G €

Research Question	Publications			Publications Respect Europe (%)		
	Number	Per M inhab.	Per G € GDP	Number	Per M inhab.	Per G € GDP
Q1: Ecosystems	1,019	19	4	3	40	177
Q2: Citizens	839	16	3	2	29	129
Q3: Industry	2,125	40	8	2	20	88
Q4: Bioeconomy	530	10	2	4	44	193
Q5: Gap	760	14	3	4	45	**201**
All	3,356	63	12	**3**	30	**134**

The publications produced in South Africa in the field of water represent 3% of the European publications. When the number of publications is standardized per GDP, South Africa and Europe can be compared (South Africa is 134% of Europe). When analyzing South Africa S&T production in the light of the five research questions expressed in the Water JPI SRIA, the main strengths are in the **Gap, Bioeconomy and Ecosystems** areas. The Industry sector shows the lowest intensity.

During the studied 15-year period, South Africa has multiplied its publications by 3, which represents 111% of the European increase in the same period. South Africa publishes with 98 countries, 27 of which are EU Member States and Associated Countries. The International Cooperation Index is 55% and the European Cooperation Index is 24%.

Who

is publishing with South Africa?

In the world	%	In Europe (MS+AC)	%
EU (MS+AC)	23.5	UK	4.9
USA	7.6	GERMANY	3.0
AUSTRALIA	4.3	FRANCE	2.7
CANADA	1.7	NETHERLANDS	2.7
NIGERIA	1.5	SWEDEN	1.4

Who

is funding this research?

Funding Agencies	%*
SOUTH AFRICAN NATIONAL RESEARCH FOUNDATION NRF	51.7
SOUTH AFRICAN WATER RESEARCH COMMISSION	12.8
UNIVERSITY OF KWAZULU NATAL	4.1
EU	4.0
UNIVERSITY OF JOHANNESBURG	2.8

Which

Institutes are doing the work?

Organizations	%
UNIV PRETORIA	13.6
UNIV CAPE TOWN	12.3
UNIV KWAZULU NATAL	10.0
UNIV STELLENBOSCH	9.1
UNIV WITWATERSRAND	9.1

Analysis
per topic:

Who
is leading?

	Organization	%	Authors	%
Q1	UNIV CAPE TOWN	19.5	LE MAITRE DC	2.4
	COUNCIL FOR SCIEN. AND INDUS RES CSIR	11.6	RICHARDSON DM	2.3
	UNIV STELLENBOSCH	11.3	VAN WILGEN BW	2.2
	UNIV KWAZULU NATAL	8.8	PERISSINOTTO R	1.9
	UNIV WITWATERSRAND	8.4	SNYMAN HA	1.9
Q2	UNIV PRETORIA	14.7	MAMBA BB	3.8
	UNIV JOHANNESBURG	8.8	MOMBA MNB	3.7
	UNIV WITWATERSRAND	8.8	HAARHOFF J	2.9
	UNIV KWAZULU NATAL	8.3	GRABOW WOK	2.3
	UNIV CAPE TOWN	8.0	VENTER SN	1.9
Q3	UNIV CAPE TOWN	16.2	LUTJEHARMS JRE	1.3
	UNIV PRETORIA	12.9	EKAMA GA	1.2
	UNIV STELLENBOSCH	10.2	WENTZEL MC	1.0
	UNIV KWAZULU NATAL	9.4	CHOWN SL	0.9
	UNIV WITWATERSRAND	7.2	PAKHOMOV EA	0.8
Q4	UNIV PRETORIA	15.8	ANNANDALE JG	3.8
	UNIV KWAZULU NATAL	11.1	JOVANOVIC NZ	2.6
	UNIV STELLENBOSCH	9.2	STEYN JM	2.5
	COUNCIL FOR SCIEN. AND INDUS RES CSIR	7.4	JEWITT GPW	2.1
	UNIV WITWATERSRAND	7.0	VAN RENSBURG LD	1.9
Q5	UNIV CAPE TOWN	13.7	HUGHES DA	5.0
	UNIV KWAZULU NATAL	9.7	JEWITT GPW	1.8
	UNIV PRETORIA	8.9	TAIGBENU AE	1.8
	UNIV WITWATERSRAND	8.3	LE MAITRE DC	1.7
	RHODES UNIV	7.8	SNYMAN HA	1.6

10.6 Major RDI programmes

The major funding agencies related to water challenges and the Water JPI SRIA are:

WRC - WATER RESEARCH COMMISSION

The Water Research Commission (WRC) serves as the R&D partner of the sector leader, the Department of Water Affairs (DWA), as part of the Ministry of Water and Environmental Affairs, and provides the sector with knowledge and capacity to ensure sustainable management of water resources and to enhance water services. The WRC aims to develop and support a water-related knowledge base in South Africa which is both representative and sustainable, with all the necessary competencies and capacity vested in the corps of experts and practitioners within academia, science councils, other research organizations and government organizations (central, provincial and local) which serve the water sector. The WRC provides the country with applied knowledge and water-related innovation, by continuously translating needs into research ideas and, in turn, transferring research results and disseminating knowledge and new technology-based products and processes to end-users. In summary, the mandate of the WRC is summarized as follows:

- Promote coordination, cooperation and communication in the area of water research and development
- Establish water research needs and priorities
- Stimulate and fund water research according to priority
- Promote the effective transfer of information and technology
- Enhance knowledge and capacity building within the water sector

The WRC's investment in research and development (R&D) is accomplished through research projects and programs in the solicited and non-solicited categories. WRC has five Key Strategic Areas (KSAs) related to water-centered knowledge, each providing a framework for investment in key water-related needs. These KSAs allow for multidisciplinary studies and are focused on solving problems related to national needs and supporting society and the water sector. Each of the KSAs provides for pilot or seed investigations, R&D projects/programs and capacity-building initiatives. The KSAs also aim to support technology transfer, commercialization and pilot implementation projects as well as other knowledge dissemination drives. Of the five key KSAs, four are water-centered and address investment focused mainly on knowledge creation, while the fifth KSA mainly addresses knowledge dissemination and information management.

Four research-related key strategic areas are Water Resource Management, Water- Linked Ecosystems, Water Use and Waste Management, and Water Utilization in Agriculture. In 2012/13, the fifth KSA "Business Development, Marketing and Communications" was reoriented to provide strategic direction to the business development, communication, marketing and branding goals of the WRC, with an emphasis on research uptake and knowledge dissemination. KSAs and their thrusts are summarized below:

KSA 1 - WATER RESOURCE MANAGEMENT

- Water resource assessment and planning
- Water quality management
- Water resource protection
- Water resources and climate
- Water resource institutional arrangements

KSA 2 - WATER LINKED ECOSYSTEMS

- Ecosystem processes
- Ecosystem management and utilization
- Ecosystem rehabilitation

KSA 3 - WATER USE AND WASTE MANAGEMENT

- Water services - Institutional and management issues
- Water supply and treatment technology
- Sustainable municipal wastewater and sanitation
- Sustainable and integrated industrial water management
- Mine-water treatment and management
- WaterSmart Fund

KSA 4 - WATER UTILIZATION IN AGRICULTURE

- Water utilization for food and fiber production
- Water utilization for fuel-wood and timber production
- Water utilization for poverty reduction and wealth creation in agriculture
- Water resource protection and reclamation in agriculture

Development of innovative solutions to address South Africa's water challenges is another priority of the WRC. In 2012/13 alone, a total of 18 innovations were reported across the KSAs. Over the past 5 years the WRC has completed 378 research projects.

The Water Research Act makes provision for a Water Research Fund, which derives its income mainly from levies on water made available for various uses. Diversification of income sources is gaining momentum, with the main other source being income derived from research fund management on behalf of specific sponsors and donors.

Leveraged income is obtained from both local and international sources, where the main source of income was due to support by various Government departments for specific research and for other knowledge-sharing projects. Levies constitute 87% of the total income, while 13% of the income is obtained from other sources.

The overall investment in research projects amounted to 116.7 M rand (7.75 M€). Total investment in the support of knowledge creation, sharing and dissemination amounted to 144.7 M rand (9.61 M€).

NRF - NATIONAL RESEARCH FOUNDATION

The National Research Foundation is the intermediary agency between the policies and strategies of government and those institutions that perform research. Unlike other Science Councils whose role is research performance, the NRF primarily fulfils an agency role, with a smaller portion of its activity allocated to research performance through the National Research Facilities.

Funding from the NRF is largely directed towards academic research, developing high-level human resources, and supporting the nation's National Research Facilities. Funding opportunities cover the full spectrum of beneficiaries: from students and researchers through to Higher Education Institutions (HEIs) and staff at HEIs, and from scientists involved in bilateral and multilateral joint research projects to private individuals or companies and Science Councils.

The NRF receives its mandate from the National Research Foundation Act. According to section 3, the objective of the NRF is to "…*promote and support research through funding, human resource development and the provision of the necessary facilities in order to facilitate the creation of knowledge, innovation and development in all fields of research including indigenous knowledge, and thereby contribute to the improvement of the quality of life of all the people of the Republic*."

The NRF performs a dual function in the National System of Innovation (NSI): as an Agency that steers the system according to strategic policies, and as a research performer. The research areas of the NRF are influenced by the Grand Challenges set forward in the Ten-year Innovation Plan that sets projections for the year 2018. The Ten-year Innovation Plan identified South Africa's Grand Challenges in science and technology as Bioeconomy; Space Science and Technology; Energy Security; Global Change; and Human and Social Dynamics.

The NRF adopted the following broad strategic goals as part of Vision 2015:

- Promoting of internationally competitive research as the basis for a knowledge economy;
- Growing a representative science and technology workforce in South Africa;
- Providing cutting-edge research, technology and innovation platforms;
- Operating world-class evaluation and grant making systems; and
- Contributing to a vibrant national innovation system.

The NRF consists of three divisions, namely:

(1) Research and Innovation, Support and Advancement (RISA) is the agency that constitutes the research support and promotion task of the NRF;

(2) The South African Agency for Science and Technology Advancement (SAASTA) is the business unit which provides and manages cross cutting activities that advances science and technology into various communities in South Africa; and

(3) The National Research Facilities undertake high-end research in specific research fields.

In the following sections, the role and objectives of a selected group of these divisions will be detailed according to their relevance to the Water JPI SRIA topics.

Research and Innovation, Support and Advancement (RISA)

RISA is the intermediary between government strategies and research institutions and researchers. Its intermediary function is based on disbursing of funds made available by various sources, including:

- Funds allocated to the NRF via the Parliamentary core grant; and
- Funds received from various government departments, for example:
  - Department of Science and Technology (DST);
  - Department of Labour (DoL);
  - Department of Trade and Industry (the DTI); and
  - Department of Environmental Affairs and Tourism (DEAT).

As the grant-making programme of the NRF, the RISA translates the science and technology strategies and policies of government into programmes and initiatives that support research institutions and researchers. The key function of RISA is to ensure that the country has appropriately qualified people and the necessary high-level infrastructure to produce knowledge that can transform the economy of South Africa into one that can compete globally. This is done through:

- Investing on a competitive basis in knowledge, people and infrastructure;
- Developing research capacity and advancing equity and equality among researchers;
- Promoting the development of institutional capacity at HEIs; and
- Facilitating strategic national and international research partnerships and networks.

RISA provides support to the NSI by:

- Implementing government policies such as the National Research Development Strategy (NRDS) and managing appropriate initiatives;
- Coordinating and managing peer-review and evaluation systems to enable independent and objective research funding decisions;
- Managing a grant-making and administration service;
- Establishing high-end instruments such as the Centers of Excellence (CoEs) and the South African Research Chairs Initiative (SARChI) to drive human capital development;
- Negotiating and servicing international and inter-agency research collaboration agreements; and
- Facilitating collaboration between various stakeholders within the NSI.

The above are achieved through various instruments and services resident in six RISA directorates, which are listed as follows;

RISA's investment in knowledge, people and infrastructure focuses on six areas, which are embodied as RISA directorates, as follows;

Applied Research, Innovation and Collaboration (ARIC)

The principle goal of ARIC is to promote and develop applied research within the South African National System of Innovation (NSI).

ARIC programmes complement innovation support interventions and programmes such as those of the Technology Innovation Agency (TIA) and the Support Programme for Industrial Innovation (SPII). The NRF tries to ensure a balance through support for environmental, economic, social and political innovations that are important and relevant but may not necessarily be targeted for technological innovation and commercialisation. Among ARICS program, only one is relevant enough to mention here;

2ENRICH:

2ENRICH is a cooperative programme between the NRF and its equivalent in the Netherlands, the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO). 2ENRICH aims to create products that will improve the quality of life of people in the sub-Saharan region. The programme's thematic design is based on the Millennium Development Goals, with agriculture and water as recommended focus sectors. The programme is managed by the NRF (ARIC) and the NWO with the objective of transferring and exchanging of technological knowledge between Dutch and African universities, knowledge institutions and private or semi-private enterprises. The NWO has set aside R26.4m and the NRF R7.7m to fund the pilot phase of 2ENRICH over a five-year period.

a) Grants Management and Systems Administration (GMSA)

The Grants Management and Systems Administration (GMSA) Directorate implements grant management in partnership with and on behalf of the funding directorates of RISA, namely Knowledge Fields Development (KFD), International Science Liaison (ISL), Human and Institutional Capacity Development (HICD) and Applied and Industrial Research and Innovation (AIRI). Grant management can broadly be divided into pre- and post-award activities.

GMSA aims to:

- Develop and maintain cost-effective, efficient grant management processes;
- Simplify business processes and interfaces;
- Improve the IT systems critical to GMSA business; and
- Simplify data retrieval and reporting. The NRF online and Phoenix systems are critical to the efficacy of GMSA. The long-term vision is to replace the NRF online system with InfoEd, in line with the RIMS InfoEd project.

b) Human and Institutional Capacity Development (HICD)

The goal of the Human and Institutional Capacity Development (HICD) directorate is to develop institutional research capabilities and infrastructure in parallel with the appropriate human resources to drive R&D strategies within the NSI. The programmes under this directory are designed for enabling better and equalitarian facilities for junior researchers, PhD candidates and other researchers in need of financial support without gender and racial discrimination. There is no relevant programme in relation to Water JPI SRIA topics worth mentioning under this directorate.

c) International Relations and Co-operations (IR&C)

Whilst there has been a noticeable increase in the rate of internationalization of South African research activities, with an ever-increasing number of researchers and students are being exposed to strategic bi- and multilateral programmes, there is much yet to be accomplished. The activities of the IRC are targeted and directed towards supporting and facilitating continued success in the international science arena, with a particular focus on strengthening the footprint on the African continent through interaction with African researchers and research bodies.

Within this context, IRC contributes to the achievement of the NRF's strategic goals and vision by sourcing funds for research (locally and abroad); facilitating and promoting international liaison between researchers and research institutions; promoting participation in international scientific activities through maintaining membership of appropriate international science organisations; and initiating liaison with structures involved in the protection of intellectual property rights.

The mission of IRC within the NRF is multidimensional and cross-cutting are:

- To contribute pro-actively to the internationalisation of science and of higher education;
- To facilitate the generation and transfer of knowledge and technology to achieve international competitiveness for South Africa;
- To enhance international science collaboration (networking), especially amongst emergent and developing economies – South- North research collaboration;

- To promote and support continental/ regional scientific collaboration in order to contribute to socio-economic and sustainable growth on the African continent;
- To contribute to an enabling process of accessing international (research support) opportunities throughout the NRF, in particular the National Research Facilities (NFs);
- To contribute to the imperatives of redress and equity within the national science system and, thereby; and
- To promote and support strategic human resource development as a contribution to the national system of innovation.

Some of the interesting programmes subordinated to this directorate are:

Inkaba yeAfrica (IyA)

Inkaba, a Xhosa word encapsulating a sense of total interconnectivity, literally means 'navel'. The aim of the programme is to understand earth system processes and their interaction at different scales and rates. The research will be holistic and socially relevant, and will cover sustainable resources (energy, clean water, soil); manageable risks (mine safety, climate change, tsunami early warning); earth observation and monitoring (satellite systems, magnetic field, geohistory); and human capacity building (next-generation scientists and public awareness).

Focus on Africa (FoA)

In line with the Consolidated Plan of Action of the African Union (AU) and New Partnership for Africa's Development (NEPAD), the NRF is prioritising its focus on Africa, particularly interventions that respond to African challenges. This is done mainly by servicing bi-lateral agreements between South Africa and other African countries. Special attention is being paid to human capacity development and skills enhancement on the continent, with an underlying contribution to the socio-economic development of both the southern African region and the continent.

The main aims of the FoA Programme include:

- Facilitating access to international opportunities and resources for Africa;
- Directing the focus on Africa and the internationalisation of its R&D;
- Contributing to socio-economic and sustainable development of the African region; and
- Promoting international competitiveness through knowledge transfer.

The following FOA calls are planned for the 2013/14 financial year:

Month	Partner Country
April	Namibia
April	Uganda
May	Mozambique
May	Tanzania
June	Angola

d) Knowledge Fields Development (KFD)

The broad aim of KFD is to facilitate the creation of new knowledge and research capacity within the context of national research and developmental challenges. This is achieved by pushing back the frontiers of existing knowledge and expertise, and developing new fields of knowledge and associated research capacity.

KFD achieves these goals by:

- Investigating, mapping and analyzing research interests and trends within and across disciplines and knowledge fields;
- Promoting active interaction between researchers within and across disciplines and knowledge fields;
- Strengthening scientific and professional organizations in the South African research community; and
- Refining and redefining research calls in view of the above developmental interventions.

KFD manages programs directed at addressing national priorities. Research funding programs are initiated by the NRF itself, often in consultation with the research community. Some of the current programs that are relevant to the SRIA questions are;

Marine and Coastal Management (MCM) Research Programme: The MCM is a collaborative programme between the NRF and the departments of Water and Environmental Affairs (DEA) and Agriculture, Forestry and Fisheries (DAFF), aiming to promote biodiversity through marine research.

South African Biosystematics Initiative (SABI)

SABI aims to develop a representative community of biological systematists who will address issues relevant to South Africa's rich biological heritage.

South African Network for Coastal and Oceanic Research (SANCOR)

SANCOR promotes science in the marine and coastal environments with emphasis on (amongst others) addressing challenges and gaps in existing research and tackling new areas of research.

SEAChange Programme

Supported by SANCOR, the SEAChange programme is structured into four interdependent themes: Ecosystems and Change, Ecosystems and Society, Ecosystem Functioning and Marine Biotechnology.

e) Knowledge Management and Evaluation (KM&E)

The Knowledge Management and Evaluation (KM&E) directorate is responsible for:

- Implementing and acting as custodian of knowledge management processes and principles primarily within the NRF and generally in the wider NSI context;
- Providing information management services and advice;
- Facilitating the appraisal and review of research and research funding programs; and
- Evaluation and rating of the outputs of individual researchers.

There is no programme related to the SRIA topics under this directorate.

National Research Facilities of NRF

There are seven National Research Facilities managed by the NRF, which are clustered into three broad categories aligned to the science missions of the National Research and Development Strategy. Three clusters and the facilities are listed in the table:

Astro/Space/Geosciences	Biodiversity/Conservation	Nuclear Sciences
South African Astronomical Observatory (SAAO)	South African Institute for Aquatic Biodiversity (SAIAB)	iThemba Laboratory for Accelerator Based Sciences (iThemba LABS)
Hartebeesthoek Radio Astronomy Observatory (HartRAO)	South African Environmental Observation Network (SAEON)	
Hermanus Magnetic Observatory (HMO)	National Zoological Gardens of South Africa (NZG)	

The National Research Facilities that could rather be related to the Water JPI SRIA topics are briefly explained following.

The South African Institute for Aquatic Biodiversity (SAIAB) runs the major marine flagship project, the African Coelacanth Ecosystem Programme (ACEP), which is funded by the DST and managed through the South African Environmental Observation Network (SAEON) Elwandle Node as a joint venture with Marine and Coastal Management (MCM). The ACEP II research Programme was finalized during 2008, and eight proposals received funding. The Programme is scheduled to run from 2007/08 until 2011/12. SAIAB's works related to freshwater ecosystems are in compliance with official bodies at central level. Furthermore, all research aims to complement the research needs of implementing agencies such as the Department of Environment and Water Affairs, the Department of Agriculture, Forestry and Fisheries and the Water Research Commission.

The South African Environmental Observation Network (SAEON) was involved in over 30 international science initiatives with countries in Europe, North and South America, Australia and Africa. The functional nodes were allocated seed-funding to initiate projects with the Environmental Long-term Observatories of Southern Africa (ELTOSA). The Fynbos Node took part in an international program of the International Long-term Ecological Research Network (ILTER) to assess the linkages between ecosystem services and community livelihoods.

SAEON consists of six geographically dispersed environmental observatories (field stations and research sites), representing the diverse landscapes, coastal areas and offshore marine environments in South Africa. The environmental observatories are essentially nodes of the national observation and monitoring system.

The research facilities at the nodes include automated weather stations and field-based apparatus for assessing and monitoring flora, fauna, soil, water and the atmosphere.

The National Zoological Gardens of South Africa (NZG) established the Center for Conservation Science as a hub for research in the two focus areas of conservation biology and conservation medicine. The development and promotion of conservation medicine as a research focus aligns the NZG internationally with the Conservation Breeding Specialist Group under the World Association of Zoos and Aquaria (WAZA). This opens up opportunities for collaboration and provides the NZG with access to disease risk-assessment tools.

2013 Budget of the NRF

NRF receives in excess of 90% of its funding from government through the MTEF appropriations in three forms, namely: baseline allocation, ring-fenced funds as designated by the DST, and designated funds for specific projects and programmes from the DST and other government departments. Designated funds represent over 50% of the total income. Some 3% of income is generated from self-generated income, namely sales of services, entrance fees and interest.

NRF' total budget for 2014 is 2,16 M€ and more than 163 M€ of it was used for the activities of RISA directorates and National Research Facilities. Budget allocated among different bodies of NRF are shown in the Figure 7 and the table below.

Figure 1

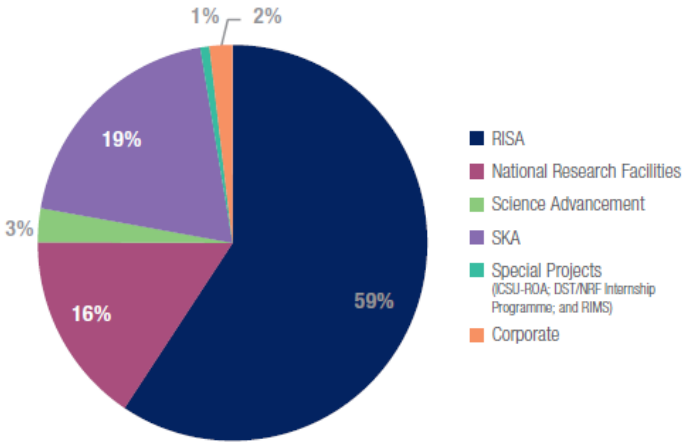


Figure 7 - Total expenditure of the NRF

NRF's Agency/National Research Facility	2013 Annual Budget (Euros)
RISA	131.000.000
iThemba LABS	13.460.000
SAAO	4.875.000
HartRAO	2.092.000
SAIAB	2.220.000
NZG	7.670.000
SAEON	2.350.000
TOTAL	**163.667.000**

10.7 Connections between Water JPI SRIA and the RDI programmes and policies of South Africa

Water JPI SRIA Questions	Rate (1 to 6)*	Brief motivation of the rating
Sustainable ecosystems	4	The KSA 2 of the WRC is directly related to this SRIA question. A constant flow of funding is provided for national researchers working in this field. Furthermore, South Africa is willing about exploiting its bio-diversity as a capital for medicine and other uses. Three of the research facilities under NRF have intensified focus on marine and fresh water bio-systems for the same reason.
Developing safe water systems for the citizens	3	Although South Africa is a water scarce region and supplying good quality water for domestic use and sanitation is still a concern for some parts of the country, the RDI interest is not that significant according to our enquiry. It is probably because this topic is more related to infrastructure supervision rather than RDI activities. Again, there is a KSA focusing on this issue and providing funds in this field.
Promoting competitiveness in the water industry	3	Thanks to the WRC's funds, innovative outcomes are not surprising in Water RDI. Especially the innovation phase of this area is satisfying. In 2012 alone, there were 11 projects that are realized thanks to the WRC's funds. Furthermore, the concept of competitiveness in general receives considerable appreciation due to the South Africa's long term ambition to become a knowledge based economy.
Implementing a water-wise bio-based economy;	4	There is a KSA on this issue. Similar to the reasons listed for SRIA on Sustainable Ecosystems, a bio-based economy is of great importance for South Africa
Closing the water cycle gap	3	This field has the potential to be developed further, considering the KSAs of WRC. On the other hand dedicated funds to the space science, astronomy and observations tell something about South Africa's eagerness to be monitor its waters in a more accurate way and be prepared for the uneven impacts of the climate change.

*1 = weak connection with Water JPI SRIA

6 = strong connection with Water JPI SRIA

10.8 Acronyms of SOUTH AFRICAN institutions and reference documents

Acronym	Institution Name	Website
ARIC	Applied Research, Innovation and Collaboration	http://www.nrf.ac.za/about_key_facts.php?fid=48
CoEs	Center of Excellence	http://www.nrf.ac.za/coes.php
DST	Department of Science and Technology	www.dst.gov.za/
DWA	Department of Water Affairs	www.dwaf.gov.za/
DWEA	Department of Water and Environmental Affairs	http://www.dwa.gov.za/Dir_WQM/docsPolic.asp
GMSA	Grants Management and Systems Administration	http://www.nrf.ac.za/about_key_facts.php?fid=12
HartRAO	Hartebeesthoek Radio Astronomy Observatory	http://www.hartrao.ac.za/
HEIs	Higher Education Institutions	http://www.dhet.gov.za/
HICD	Human and Institutional Capacity Development	http://hicd.nrf.ac.za/
IR&C	International Relations and Co-operations	http://www.dfa.gov.za/
NDP	National Development Plan	http://www.gov.za/issues/national-development-plan/
NRDS	National Research Development Strategy	http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/za/policydocument/policydoc_0002
NRF	National Research Foundation	http://www.nrf.ac.za/
NSI	National System of Innovation	http://www.csir.co.za/research_and_development/national_system_innovation.html
NWA	National Water Act	http://www.dwaf.gov.za/Documents/Legislature/nw_act/NWA.pdf
NZG	National Zoological Gardens of South Africa	http://www.nzg.ac.za/
RISA	Research and Innovation, Support and Advancement	http://www.risa.org.za/
SAAO	South African Astronomical Observatory	http://www.saao.ac.za/
SAEON	South African Environmental Observation Network	http://www.saeon.ac.za/
SAIAB	South African Institute for Aquatic Biodiversity	www.saiab.ac.za/
SARChI	South African Research Chairs Initiative	http://hicd.nrf.ac.za/?q=node/16
SAASTA	The South African Agency for Science and Technology Advancement	http://www.saasta.ac.za/
THRIP	Technology and Human Resources for Industry Programme	http://thrip.nrf.ac.za/SitePages/Home.aspx
WRC	Water Research Commission	www.wrc.org.za/
	NRF Vision 2015: Strategic Plan of the National Research Foundation	http://www.nrf.ac.za/files/file/nrf_vision_2015.pdf
	SACCESS Report on Opportunities for European Researchers within the South	http://www.esastap.org.za/download/opportunities_eu_sais.pdf

	African	
	SACCESS Report on Supporting the EU access to South Africa's research and innovation Programmes	http://cordis.europa.eu/publication/rcn/14473_en.html
	ERAWATCH COUNTRY REPORTS 2010: South Africa	http://erawatch.jrc.ec.europa.eu/erawatch/export/sites/default/galleries/generic_files/file_0086.pdf
	NRF Annual Performance Plan 2013/14 – 2015/16	http://www.nrf.ac.za/financial_annual_reports.php
	NRF Annual Performance Report 2012/2013	http://www.nrf.ac.za/financial_annual_reports.php
	McKinzey Quarterly, Confronting South Africa's water challenge	http://www.mckinsey.com/insights/sustainability/confronting_south_africas_water_challenge
	Ten Year Innovation Plan	http://www.info.gov.za/view/DownloadFileAction?id=94066

11. USA

11.1 Context and RDTI

The United States has the third largest population in the world, estimated to be 315.1 M inhabitants in 2012. The population is growing at 0.91%, with 82% of inhabitants dwelling in cities (GWI). The most populous cities are New York City, Los Angeles, Dallas, Miami and Chicago.

Per capita GDP in 2012 was 47.5 k€, the United States constitutes one of the most significant water markets in the world. The US R&D system is sizeable, with total expenditures exceeding 320 billion € in 2011 (ERAWATCH). The US has the second largest desalination market in the world just after Saudi Arabia. Water and energy are closely connected in the US. The Thermal electric power industry is the largest consumer of water

Private sector R&D is dominant at approximately 70%, and the public sector research is mainly at federal level (25%). R&D was 2.89% of GDP in 2009, with a current government target of increasing this to over 3%.

The climate of the US ranges covers a wide range from arctic tundra, through temperate, to arid regions. It is rich in natural resources, with numerous lakes, rivers and mountain ranges. Its lakes and waterways cover 664,709 km², and it has nearly 20,000 km² of coastline. There is also 223,850 km² of irrigated land.

There is a long history and a large number of bilateral links between European research centers and USA agencies and universities. This has been encouraged in many of the global research programmes, overseen and facilitated by international offices, e.g. through UNESCO, IGBP, WMO. Exchange schemes to encourage the mobility of US and European researchers are common to many countries and have encouraged collaboration e.g. on climate change and water management. An example of an EU level initiative is the US-EU Agreement for Scientific and Technological Cooperation designed to create a framework to facilitate science and technology exchanges. These exchanges typically raise topics such as sharing of research results, intellectual property protection, research access, tax considerations, safety and security, access to information, and ability to use biomaterials and organisms. This agreement also assists with the implementation of scientific standards, development of scientific infrastructure, and promotion of cross-national educational experiences. International trade and partnerships between US and equivalent agencies are considered to be helped by these types of agreements. The first agreement was signed in 1998 and renewed in 2004. (Source: Delegation of the European Commission to the USA,)

11.2 Water challenges

The US faces a wide range of challenges in ensuring that its population's water needs are sufficiently met. Water scarcity issues are apparent in the Western states, as a result of a much higher population growth rates and the arid climates in many of these states, including California and Arizona. More widely, US population will continue to increase from 315 M in 2012 to 440 M people in the year 2050, increasing the demands on water resources in all areas.

The water supply system is fragmented, with more than 55,000 water agencies and 20,000 wastewater agencies scattered across the US This fragmentation has resulted in inadequate capital investment in infrastructure. A lack of capital investment to maintain the infrastructure has led to water quality and pollution problems such as recurring sewer overflows in major cities and low

quality of drinking water in small communities. The federal government provides some funding and monitoring of water systems, but it is the state, local and tribal laws that govern the distribution of water, resulting in regional disputes and policy inconsistencies.

The US is seeking to replace its dependence on oil with alternative forms of energy. These technologies often require water as part of their process, increasing its demand. There are also increasing issues of water pollution, eg. due to runoff from land of pesticides and fertilizers.

The responses to natural hazards is also high on political agendas, such as that which followed Katrina, and there is public concern around the impacts of climate change, including increase in the frequency of floods and drought (USACE Civil Works Strategic Plan 2011-2015)

11.3 Institutional framework

The US Research System is large and decentralised. Policy is fashioned in bottom-up manner through the activities of Departments and Agencies with substantial intramural and extramural R&D. The prominence of private sector expenditures on research and development is a hallmark of the US system. The private sector funds 60% of the country's gross expenditure on research and development, of which nearly all of these funds flow to private sector performers. The next largest funder of research and development is the Government, which funds 32% of Research and Development; these funds are relatively evenly split between government (public research organisations), business enterprises, and higher education performers. Higher education and private non-profit organisations each comprise 4% of the nation's gross expenditures on research and development.

Most research infrastructure in the US is funded at the national level through mission-specific agency initiatives. There is no nationwide research infrastructure roadmap. Different agencies take different approaches. Institutional funding is not a major feature of the national R&D system in the US. The federal government does not directly allocate block funds, as a general rule, to universities or private non-profit institutes to support institutional tasks

Most public R&D funding in the US system is awarded by mission-oriented agencies and other research bodies (such as NSF) in response to competitive solicitations. Funding is typically awarded on a project basis to investigators or to centers. There is a government portal which lists public funded projects.

Basic research accounts for more than 20% of all R&D in the United States; more than half of all basic research is funded by the federal Government, and more than half of all basic research is performed by Universities. Applied research comprises nearly 20% of R&D and development accounts for the remaining 60%. (Source: NSF, Division of Science Resources Statistics, National Patterns of R&D Resources, 2012). R&D can also be supported through mechanisms outside the standard mission-oriented and competitive solicitation process.

The leading departments and agencies based on size of public R&D expenditures are the US Department of Defense and the Department of Health and Human Services. Several agencies operate research laboratories. In terms of basic research, the National Science Foundation is a key player. Although the research system is decentralised and fragmented, budgetary policy plays a role in priority setting through an annual budgetary process managed by the Office of Management and Budget; however agency R&D budgets are coordinated through the Office of Science and Technology Policy (OSTP). The US does not have a formal centralised R&D investment plan or target.

The OSTP is located in the Executive Office of the President and has a mandate to advise the President and others on the effect of science and technology policy on domestic and international affairs. OSTP also acts as an inter-agency coordinating body. The Executive Branch of the government includes 12 federal departments and 18 federal agencies that fund and/or conduct research. Funding through the federal departments and agencies in the executive branch occurs as a result of authorisation by the US Congress.

There are a number of federal agencies with responsibilities for water, including:

- Environmental Protection Agency (EPA), which is responsible for establishing and enforcing national environmental regulations, including those governing water and wastewater.
- The Department of Agriculture has several research and funding programmes related to water and soil quality, and the impact of agricultural pollution.
- The Department of the Interior has several water quality programmes administered by the Bureau of Reclamation (USBR), National Park Service (NPS), and the U.S. Fish and Wildlife Service (FWS).
- The Department of Commerce has water quality programmes administered by the National Oceanic and Atmospheric Administration (NOAA)
- The Department of Defense administers water-related infrastructure programmes through the U.S. Army Corps of Engineers (USACE). These programmes focus on flooding and related planning assistance to individual states, but also include water quality.
- The Department of Transportation (DoT) has specific infrastructure and water-quality programmes, designed to ensure that surface transportation systems and storm runoffs do not adversely affect wetlands or water quality.
- The Department of Homeland Security (DHS) has several programmes related to ensuring the safety of the domestic water supply.

11.4 USA, water use and market overview

Water use in US[1]		
Sector	Sectoral water use (%)	Trend 1950 - 2000 (%)
Thermo electric Power	49	+3
Irrigation	31	-8
Public Supply	11	+2
Industrial	4	-8
Aquaculture	2	+52
Mining	1	-11
Self supplied Domestic	1	-10
Live stock	1	+7

Estimates of water use in the United States indicate that about 410 billion gallons per day (Bgal/d) were withdrawn in 2005 for above mentioned categories. This total is slightly less than estimated in 2000, and about 5% less than total withdrawals in the peak year of 1980. Withdrawals for irrigation in 2005 were 128 Bgal/d, about 8% less than in 2000. The number of acres irrigated using sprinkler and microirrigation systems has continued to increase and in 2005 accounted for 56% of the total irrigated acreage. Main challenges for the US are drought and water scarcity in the Mid-West and Western part of the country and polluted surface water.

With more than 307 M inhabitants and a per capita GDP of 47,500 USD, the United States constitutes one of the most significant water markets in the world[1]. The US has the second largest desalination market in the world just after Saudi Arabia[2].

Water and energy are closely connected in the US. The Thermal electric power is the largest consumer of water even as the upcoming shale gas industry.

1 SOURCE: USGS 2005

2 SOURCE – GLOBAL WATER MARKET 2011 FROM THE PUBLISHERS OF GLOBAL WATER INTELLIGENCE

Market forecast 2010 US[2]	
Total water market: 107607 million USD	
Sector	Share (%)
Utilities	75
Bottled water	14
Industrial water	5.3
Point of use equipment	2.9
Irrigation equipment	2.8

Market forecast[2]			
Sector (CAPEX)	Time frame	Value (Million USD)	Increase / decrease (%)
Drinking water [1]	2009 – 2016	12000 - 22500	+ 87
Waste water networks	2009 - 2016	8000 - 17000	+ 125
Waste water treatment plants	2007 - 2016	6000 - 10000	+ 66
Industrial expenditure	2007 - 2016	2700 - 3800	+ 40
Water re use	2007 - 2016	300 – 1900	+ 533
Desalination	2009 - 2016	580 – 900	+ 55

[2] THIS INCLUDES WATER RESOURCES (INCLUDING DESALINATION), WATER DISTRIBUTION NETWORKS (NEW BUILD AND REHABILITATION AND DRINKING WATER TREATMENT PLANTS (NEW BUILD AND REHABILITATION)

11.5 Analyses of scientific publications

Population: 317 M inhabitants GDP: 11,858 G €

Research Question	Publications			Publications Respect Europe (%)		
	Number	Per M inhab.	Per G € GDP	Number	Per M inhab.	Per G € GDP
Q1: Ecosystems	22,189	70	2	74	146	**91**
Q2: Citizens	22,522	71	2	66	130	82
Q3: Industry	75,520	238	6	60	117	74
Q4: Bioeconomy	9,257	29	1	65	127	80
Q5: Gap	11,902	38	1	60	119	74
All	92,317	291	8	**71**	**139**	**87**

The publications produced in USA in the field of water represent 71% of the European publications. When the number of publications is standardized per GDP, USA and Europe can be compared (USA is 87% of Europe). When analysing USA S&T production in the light of the five research questions expressed in the Water JPI SRIA, the main strengths are in the **Ecosystems** area, though all five questions show very similar intensity. Industry and Gap are the sectors with lowest impact.

During the studied 15-year period, USA has multiplied its publications by 2, one of the lowest increase rates of the studied countries. This rate represents 74% of the European increase rate in the same period. USA publishes with 177 countries, 36 of which are EU Member States and Associated Countries. The International Cooperation Index is 35% and the European Cooperation Index is 14%.

Who

Is publishing

In the world	%	In Europe (MS+AC)	%
EU (MS+AC)	14.2	UK	2.0
CHINA	3.5	GERMANY	1.8
CANADA	3.3	FRANCE	1.4
AUSTRALIA	1.6	ITALY	1.1
SOUTH KOREA	1.3	SPAIN	1.0

Who

is funding this research?

Funding Agencies	%*
US NATIONAL SCIENCE FOUNDATION	38.1
NATIONAL INSTITUTES OF HEALTH	9.4
USDA ARS	7.7
NASA	6.6
NATIONAL SCIENCE FOUNDATION OF CHINA	6.0

Which

Institutes are doing the work?

Organizations	%
USDA ARS	6.5
US GEOL SURVEY	3.9
UNIV FLORIDA	2.7
UNIV CALIF DAVIS	2.5
TEXAS AM UNIV	2.1

Analysis

per topic:

Who

is leading?

	Organization	%	Authors	%
Q1	US GEOL SURVEY	5.9	DRISCOLL CT	0.4
	UNIV FLORIDA	2.9	LAW BE	0.3
	USDA ARS	2.9	HUANG BR	0.3
	OREGON STATE UNIV	2.8	BALDOCCHI DD	0.3
	UNIV CALIF DAVIS	2.8	HUXMAN TE	0.3
Q2	US EPA	5.6	CHEN Y	0.3
	US GEOL SURVEY	3.2	RICHARDSON SD	0.3
	UNIV N CAROLINA	2.2	AHSAN H	0.3
	UNIV FLORIDA	2.0	WESTERHOFF P	0.3
	UNIV CALIF DAVIS	1.9	EDWARDS M	0.3
Q3	NASA	2.6	WANG J	0.2
	US GEOL SURVEY	2.5	MCCLEMENTS DJ	0.2
	NOAA	2.2	LI J	0.1
	UNIV WASHINGTON	2.1	WANG Y	0.1
	UNIV WISCONSIN	1.9	ZHANG Y	0.1
Q4	USDA ARS	17.1	GRIEVE CM	0.5
	UNIV CALIF DAVIS	5.6	HOWELL TA	0.5
	UNIV FLORIDA	5.6	LAL R	0.5
	US GEOL SURVEY	3.2	DUKES MD	0.5
	UNIV ARIZONA	3.0	SOJKA RE	0.5
Q5	USDA ARS	6.3	LETTENMAIER DP	0.8
	US GEOL SURVEY	4.8	SRINIVASAN R	0.6
	UNIV ARIZONA	3.0	RODRIGUEZ-ITURBE I	0.5
	UNIV FLORIDA	2.7	ARNOLD JG	0.5
	TEXAS A M UNIV	2.7	WOOD EF	0.5

11.6 Major RDI programmes

The mayor funding agencies related to water challenges and the Water JPI SRIA are:

NSF – NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent federal agency "*to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…*" The annual budget of about 7.0 billion USD (2012), funds approximately 20% of all federally supported basic research by US colleges and universities. Funding is usually provided through limited-term grants -- currently about 11,000 new awards per year, with an average duration of three years. Most of these awards go to individuals or small groups of investigators. Others provide funding for research centers, instruments and facilities.

The foundation engages in the following activities:

- Initiate and support, through grants and contracts, scientific and engineering research and programs to strengthen scientific and engineering research potential, and education programs at all levels, and appraise the impact of research upon industrial development and the general welfare.
- Award graduate fellowships in the sciences and in engineering.
- Foster the interchange of scientific information among scientists and engineers in the United States and foreign countries.
- Foster and support the development and use of computers and other scientific methods and technologies, primarily for research and education in the sciences.
- Evaluate the status and needs of the various sciences and engineering and take into consideration the results of this evaluation in correlating our research and educational programs with other federal and non-federal programs.
- Provide a central clearinghouse for the collection, interpretation and analysis of data on scientific and technical resources in the United States, and provide a source of information for policy formulation by other federal agencies.
- Determine the total amount of federal money received by universities and appropriate organizations for the conduct of scientific and engineering research, including both basic and applied, and construction of facilities where such research is conducted, but excluding development, and report annually thereon to the President and the Congress.
- Initiate and support specific scientific and engineering activities in connection with matters relating to international cooperation, national security and the effects of scientific and technological applications upon society.
- Initiate and support scientific and engineering research, including applied research, at academic and other non-profit institutions and, at the direction of the President, support applied research at other organizations.

Three Programmes provide examples of work relevant to the priorities of the Water JPI:

The goal of the Water Sustainability and Climate (WSC) solicitation is to understand and predict the interactions between the water system and climate change, land use (including agriculture, managed forest and rangeland systems), the built environment, and ecosystem function and services through place-based research and integrative models. Studies of the water system using models and/or observations at specific sites singly or in combination that allow for spatial and temporal extrapolation to other regions, as well as integration across the different processes in that system

are encouraged, especially to the extent that they advance the development of theoretical frameworks and predictive understanding.

A further example, more specific example is provided by the Environmental Engineering Programme which supports fundamental research and educational activities across the broad field of environmental engineering (with calls in 2014 and 2015). The goal of this program is to encourage research to avoid or minimize solid, liquid, and gaseous discharges, resulting from human activity, into land, inland and coastal waters, and air, while promoting resource and energy conservation and recovery. The program also covers research to identify, evaluate, and monitor the waste assimilative capacity of the natural environment and for removal or reduction in contaminants from polluted air, water, and soils. Major areas of interest and activity in the program include environmental engineering implications of energy and resource consumption, availability of high quality water supplies and the fate and transport of contaminants of emerging concern in air, water, and soils.

European and North American environmental public research funders within the Belmont Forum have initiated several international calls, leading to international collaborations in the last few years, with other national research funders across the globe. The Belmont Forum is a high level group of the world's major and emerging funders of global environmental change research and international science councils. NSF, GeoSciences have played a major role in its development. It aims to accelerate delivery of the international environmental research priorities needed to remove critical barriers to sustainability, by aligning international resources. It acts as a Council of Principals for the broader network of global change research funding agencies, IGFA.

Foci include Coastal vulnerability, Freshwater Security and Ecosystem Services. Collaborating countries and funding agencies include: Australia, CSIRO; Austria, Ministry for Education, Science and Research; Brazil, FAPESP; Canada, NSERC and Canadian Climate forum; France, ANR; China, NSFC; European Commission, DG Research; Germany, BMBF and DFG; Japan, MEXT and JSPS; India, MoES; Norway, The Research Council of Norway; South Africa, NRF; UK, NERC; International Council for Science (ICSU); and International Social Sciences Council (ISSC)). (See www.belmontforum.org).

USGS – United States Geological Survey

Water is one of the major areas of activity in the US Geological Survey (USGS), with responsibilities for collection and dissemination of reliable, impartial, and timely information that is needed to understand the Nation's water resources. The USGS actively promotes the use of this information to:

- Minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, and land movement;
- Effectively manage groundwater and surface-water resources for domestic, agricultural, commercial, industrial, recreational, and ecological uses;
- Protect and enhance water resources for human health, aquatic health, and environmental quality; and
- Contribute to the wise physical and economic development of our Nation's resources for the benefit of present and future generations.

Relevant USGS Programs include:

- Cooperative Water Program – Conducts data collection and investigations that form the foundation for water-resources management and planning activities nationwide, through partnerships with over 1,000 State and local agencies;

- National Streamflow Information Program (NSIP) - Implements the USGS plan to ensure reliable and consistent acquisition and delivery of streamflow information at key sites;
- National Water-Quality Assessment Program (NAWQA) - Provides an understanding of water-quality of the Nation's surface water and groundwater and how those conditions may vary locally, regionally, and nationally; whether conditions are getting better or worse over time; and how water quality is affected by natural features and human activities;
- Groundwater Resources Program - Provides research and information for groundwater sustainability and ties to human and environmental needs;
- Hydrologic Research and Development - Conducts basic and problem-oriented research into varied and complex hydrologic processes that are not well understood;
- State Water Resources Research Institute Program - Supports water resources research, education, and information transfer at the 54 university-based State Water Resources Research Institutes, through the use of matching grants; and
- Hydrologic Networks and Analysis (HNA) - Includes the Federal core of the USGS water-quality networks, a variety of research and investigations, and a portion of USGS information storage, coordination, and dissemination efforts, including the National Water Information System.

There is also a group with specific responsibility for overseeing and encouraging international, including at EU and national levels, eg. though bilateral liaison and through joint action with the EU in global initiatives, such as IHDP and UNESCO.

http://water.usgs.gov/programs.html

US Army Corps of Engineers

The US Army Corps of Engineers (USACE) is an executive branch agency within the Department of Defense and a Major Command within the Army. The USACE consists of four program areas that include civil works, military construction, real estate, and research and development. The entire organization employs approximately 37,000 people.

The USACE organization consists of a Headquarters located in Washington, D.C., nine Major Subordinate Commands (MSCs), and 46 Districts, 38 of which carry out civil works responsibilities in the United States, and 6 specialized centers. Most of the MSC and District geographic boundaries are aligned with watershed boundaries. There are also several world-renowned research and development laboratories and other offices contributing to the USACE mission.

The USACE Civil Works Program is funded primarily through Energy and Water Development appropriations. Responsibilities include:

- Development and management of the Nation’s water resources;
- Support marine transportation systems for commercial navigation;
- Protection and management of the natural environment;
- Restoration of aquatic ecosystems;
- Flood risk management and emergency management; and
- Engineering and technical services in an environmentally sustainable, economic, and technically sound manner with a focus on public safety and collaborative partnerships.

EPA – Environmental Protection Agency

The United States Environmental Protection Agency[2] (EPA or sometimes USEPA) is an Agency of the US Federal Government which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress.[3] The EPA has its headquarters in Washington, D.C., regional offices for each of the agency's ten regions, and 27 laboratories. The agency conducts environmental assessment, research, and education. It has the responsibility of maintaining and enforcing national standards under a variety of environmental laws, in consultation with state, tribal, and local governments. It delegates some permitting, monitoring, and enforcement responsibility to United States and the federal recognized tribes. EPA enforcement powers include fines, sanctions, and other measures. The agency also works with industries and all levels of government in a wide variety of voluntary pollution prevention programs and energy conservation efforts.

The Agency has approximately 17,000 full-time employees, including engineers, scientists, and environmental protection specialists. A notable example of funding through the EPA in recent years is the American Recovery and Reinvestment Act (ARRA) of 2009, which was passed to provide economic stimulus for the US's flagging economy, provided 5.6 billion USD of funding for water and wastewater projects, with 3.8 billion USD going to the Clean Water State Revolving Fund and 1.8 billion USD going to the Drinking Water State Revolving Funds. In order to receive funds, each state had to sign contracts on specific projects that met the requirements of the ARRA, which included a reserve of funds for green projects and preference for American-sourced products. All fifty states met the February 17, 2010 deadline, and as of March 1, 2010, construction had been started on more than 4.5 billion USD worth of the contracts.

A good example of EU collaboration with the EPA is the collaboration on environmental research and informatics signed by the US Environmental Protection Agency and the European Commission in February 2007. The agreement, entitled "Implementing Arrangement Between the European Commission and the United States Environmental Protection Agency to Promote Cooperation on Environmental Research and Eco informatics," outlines a set of research and policy areas for cooperation and oversight mechanisms.

This was negotiated under the auspices of the bilateral Science and Technology Agreement between the United States and the European Union. The collaborative research topics included environmental information systems; development of environmental and sustainability indicators; environmental modelling; decision support tools; environment and health and environmental technologies.

Cooperation under the EPA-EC Implementing Arrangement is expected to take many forms, including direct collaboration between US and European researchers and consortia; joint sponsorship of conferences, workshops and meetings; coordinated calls for proposals and mutual participation in peer reviews and exchanges of information, methodologies and data.

USDA – US Department of Agriculture

USDA's role is significant in protecting US water resources. More than a dozen USDA agencies have programs that in some way affect the nation's water resources. Three of these agencies, the USFS, NRCS and FSA, implement programs that apply to more than 1.5 billion acres of public and private land or more than 65% of acres in the continental United States. The USFS manages 194 M acres of public forest and grasslands. NRCS and the FSA administer easement and financial assistance programs to farmers, ranchers and forest land owners who manage more than 1.4 billion acres of land. In fiscal year 2011, these investments totalled more than 10 billion USD, a large percentage of

which affect water. Even with projected budget cuts, USDA is expected to remain the federal government's single largest investor in on-the-ground conservation programs affecting the quality and abundance of the nation's fresh water resources.

These land management practices protect the nation's headwater streams –the source of drinking water for 60% of all Americans. These practices also help ensure healthier flows in rivers including during floods and droughts, provide vital wildlife habitat, protect fresh and saltwater fisheries, and preserve crucial interior and coastal wetlands.

Because the Department manages programs on both public and private lands, it is uniquely positioned to pursue innovative watershed scale conservation programs that coordinate the expertise and align the resources across multiple agencies, notably the US Geological Survey, the Environmental Protection Agency, and the US Army Corps of Engineers.

USDA Rural Development (RD) is composed of Rural Business-Cooperative Programs, Rural Housing and Community Facilities Programs, and Rural Utilities Programs. RD offers rural communities a broad array of financial, technical, and educational resources in order to establish and grow rural businesses and cooperatives. RD provides financing for single family homes and multi-family housing developments, and essential community facilities. RD helps to finance the development of electric, telephone, telecommunication, and water and wastewater infrastructures to create affordable utilities (www.rurdev.usda.gov).

The USDA through its agency the National Institute of Food and Agriculture (NIFA) is also supporting research to develop watershed and groundwater and climate models that can be linked to crop, forestry, aquaculture, and livestock models to assess risks and potential outcomes of management strategies so that development and yields can be projected reliably at different spatial and temporal scales.

The Natural Resources Conservation Service (NRCS) helps people help the land through scientifically based, locally led voluntary conservation efforts and improve natural resources on private lands. NRCS work results in productive lands and a healthy environment through reduced soil erosion; water and air quality; energy conservation; restored woodlands and wetlands; enhanced fish and wildlife habitat; and reduced upstream flooding.

As the leading Federal agency for assisting in restoring watershed health on private land, NRCS provides technical and financial assistance to producers who implement conservation practices and management strategies, including the restoration and protection of wetlands, that benefit water quality and improve water management. The science behind the implementation of these conservation practices and management strategies is developed and supported by the NRCS Science and Technology Divisions, National Technical Support Centers, the Water and Climate Center, and the Wetlands Team, who are continually developing new tools to, among other things, improve snowmelt prediction capabilities, improve current conservation practice technology, improve models to track nutrients, and improve irrigation efficiency so that agricultural producers can more efficiently use water, increase water storage, and protect water quality by minimizing the potential loss of sediment and nutrients from their operations by applying science based conservation practices.

Goals and targets for water management described at the document "USDA's High Priority Performance Goal for Water" (2012).

11.7 Connections between Water JPI SRIA and the RDI programmes and policies of the US

SRIA Questions	Rate (1 to 6)*	Brief motivation of the rating
Sustainable ecosystems	6	Much of leading work in this area has been by US researchers and institutions, from perspective of both basic research and its applications.
Developing safe water systems for the citizens	6	Protecting citizens from water related hazards is an important area of US research and is very strong – often in close collaboration or parallel working with European researchers and innovations
Promoting competitiveness in the water industry	6	In world terms, the US has been very active in developing competitive processes in the water industry,
Implementing a water-wise bio-based economy;	6	Another strong area of RDI, with many commonalities with European research priorities
Closing the water cycle gap	6	There are wide variations in the importance of this issue across the US, with varying pressures due to climate and population pressures (as in Europe). This gap is viewed as a major issue at many levels of governance and a driver of significant RDI activity in public agencies, with many opportunities for collaborative working with Europe.

*1 = weak connection with Water JPI SRIA

6 = strong connection with Water JPI SRIA

11.8 Acronyms of US institutions and reference documents

Acronym	Institution Name	Website
CSIRO	Commonwealth Scientific and Industrial Research Organisation	www.csiro.au
DHS	Department for Homeland Security	http://www.dhs.gov/
DoT	Department of Transportation	http://www.dot.gov/
EPA	Environmental Protection Agency	www.epa.gov/
FAPESP	Sau Paulo Research Foundation	www.fapesp.br
FWS	Fish and Wild Life Service	http://www.fws.gov/
HNA	Hydrologic Network and Analyses	http://wa.water.usgs.gov/data/cbr_program.html
NAWQA	National Water Quality Assessment Program	https://water.usgs.gov/nawqa/
NOOA	National Oceanic and Atmospheric Administration	http://www.noaa.gov/
NPS	National Park Service	http://www.nps.gov/index.htm
NSF	National Science Foundation	www.nsf.gov/
NSERC	National Sciences and Engineering Research Council of Canada	http://www.nserc-crsng.gc.ca/
NSIP	National Streamflow Information Program	http://water.usgs.gov/nsip/
OSTP	Office of Science & Technology Policy	
USACE	US Army Corps of Engineers	www.usace.army.mil/
USBR	Bureau of Reclamation	http://www.usbr.gov/
USDA	US Department of Agriculture	www.usda.gov/
USGS	United States Geological Survey	www.usgs.gov/
WSC	Water Sustainability and Climate	http://www.nsf.gov/pubs/2013/nsf13535/nsf13535.htm
	Cooperative water programme of USGS	https://water.usgs.gov/coop/
	Use of thermal Electric Power	(USGS 2005), http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf
	Eu – US agreement for S&T Cooperation	EU-US Agreement for Scientific and Technical Cooperation.
	Government portal funded projects	http://www.grants.gov/web/grants/home.html
	Ground Water Resources Programme	http://water.usgs.gov/ogw/gwrp/
	Hydrologic Research and Development Programme of USGS	http://water.usgs.gov/nrp/hrd/
	State Water Resources Programme of USGS	http://water.usgs.gov/wrri/

12. CANADA

12.1 Context and RDTI

Canada, with an area of about 9,985,000 km², is the second larger country. The population reaches 34.9 M inhabitants, with a density of 4 inhabitants/km² and 80.8 % leaving in urban areas.
About two thirds of GDP is due to service activities, with telecommunication, tourism, Internet and aerospace areas as the most active. Canada is the first producer of Nickel, Tin and Uranium, and a large exporter of agricultural products, especially wheat. The agriculture counts for about 2% of GDP du Canada and employees 2.4 % of the population, but almost 2 M of people work in the whole area of agriculture and agro-food, contributing to 8% of the nation wealth. It produces 10% of GMO harvests of the world. Fishing is also an important activity.

Canada has the potential to be a major player in the global energy economy because of its abundant natural resources with the third-largest known oil reserves in the world and natural gas. Natural resource development supports 1.8 million jobs across Canada and generates billions of dollars' worth of tax revenue and royalties annually.

"Responsible resource development" is the Government[1] of Canada's plan to create jobs, growth and long-term prosperity for all Canadians. The plan underlines the review process for major resource projects, while strengthening environmental protection and enhancing consultations with Canada's Aboriginal Peoples in the project review and development process. As part of its plan, the Government of Canada intends to enshrine in legislation the principle of 'polluter pays.'

In Canada, spending on research and development (R&D)[2] amounted to 1.87% of GDP in 2008 (1.74 % in 2011), compared with 2.33% of GDP for the OECD as a whole. The private sector share of R&D is 46.5% (2011), and the public sector share of R&D 36.1(%) (2010).

In order to evaluate the state of science and technology in Canada, the Council of Canadian Academies highlighted the country's relative productivity in science and research. It pointed out how Canada generates 5% of the world's most heavily cited papers with only 0.5% of the world's population[3].

Canada ranks first in the G-7 in the number of publications produced on a per-capita basis. In addition, at 40%, Canada is one of the highest-ranking countries in the proportion of foreign co-authorship of scientific publications in the natural sciences and engineering (NSE)[4].

The Global Innovation Index 2013[5] places Canada 11th (score 57.6), not far from US (5th and score 60.3).

[1] http://actionplan.gc.ca/en/page/r2d-dr2/overview

[2] http://www.statcan.gc.ca/pub/11-402-x/2012000/chap/science/science03-eng.htm

[3] http://www.innovation.ca/en/ResearchinAction/InOurOpinion/CreatingspaceinnovationinCanadiancommu nities

[4] http://www.nserc-crsng.gc.ca/International-Internationale/InternationalStrategy-StrategieInternationale_eng.asp

[5] http://www.globalinnovationindex.org/content.aspx?page=data-analysis

Percentage of Canadian papers in the NSE with international collaborators, by Top 10 countries (2009)*	
Country	**%**
1. US	20.5
2. China	6.1
3. U.K.	6.0
4. France	5.1
5. Germany	5.0
6. Japan	2.6
7. Australia	2.4
8. Italy	2.3
9. Spain	2.1
10. The Netherlands	1.9

*Source: Observatoire des sciences et des technologies

The Minister of Industry, on behalf of Industry Canada, asked the Council of Canadian Academies to assess industrial research and development (IR&D) in Canada[1]. The report, *The State of Industrial R&D in Canada*, provides an in-depth analysis of research and development activities in Canadian industries. While many reports have documented Canada's historical weakness in industrial R&D, the Panel's report sheds new light on the subject by examining areas of strength and how these strengths are distributed regionally. The report also examines the alignment of IR&D strengths with Canada's areas of excellence in science and technology research and economic performance. Barriers and gaps that limit the translation of Canada's S&T strengths into innovation and wealth creation are also identified.

Four Clusters of Canada's S&T Strength have been identified, such as natural resources, ICT, heath and related life sciences and technologies, Environmental S&T (climate science, oceanography, hydrology, environmental engineering, fuel cell and hydrogen technologies, and urban geography).

Canada has developed frameworks for international collaboration via science and technology agreements with a number of international partners[2]. In some cases financial support[3] has been identified and dedicated for the enhancement of these international relationships. These are:

- Asia Pacific: China, India, Japan
- Europe: European Union, France, Germany, Russia, Sweden, UK,
- Latin America and Caribbean: Brazil, Chile
- Middle East and North Africa: Israel

[1] http://scienceadvice.ca/en/assessments/completed/research_development.aspx

[2] http://www.tradecommissioner.gc.ca/eng/science/agreements.jsp

[3] http://www.tradecommissioner.gc.ca/eng/science/funding_opportunities.jsp

12.2 Water Challenges

The Canada Water Act (1985)[1] provides the framework for the management of the water resources of Canada, including research and the planning and implementation of programs relating to the conservation, development and utilization of water resources

Overall, Canada may be considered a freshwater-rich country[2]: on an average annual basis, Canadian rivers discharge close to 9% of the world's renewable water supply, while Canada has less than 1% of the world's population. The location and average flow of Canada's largest rivers indicates that approximately 60% of the country's freshwater drains to the north, away from the 85% of the population living within 300 km of the southern border. Probably no country in the world has as much of its surface area covered by freshwater as does Canada. Particularly, the Great Lakes area,, which are shared with the United States, makes up the largest surface area of freshwater found in one place anywhere in the world. Water is used in the resources and energy industries. Canada is one of the highest water users per capita in the world.

In Canada, an estimated area of 200,000 km^2, or about 2% of the country's area is covered by glaciers and ice fields. A huge quantity of freshwater is frozen in the polar ice caps and in high mountain glaciers. Glaciers and ice fields are found in Western Cordillera and the mountains in the eastern Arctic. At present there are no reliable figures on the total number of glaciers in Canada.

The most sensitive river regions to climate change include the Atlantic coast, the Great Lakes-St. Lawrence Valley regions, the Rocky Mountains and the Prairies. The sensitivity projection for Canada's river regions in response to climate warming was derived based on an examination of the effects of projected precipitation changes on landscapes. Climate warming has the potential to cause substantial changes to flow in rivers. The most direct effects of projected climate change would be an increase in floods and river erosion.

The diversity of Canada's hydrology is a reflection of its bio-physical diversity, which can be generalized by fifteen Terrestrial Eco zones. The climates of Canada range from continental in the south to boreal or subarctic in the mid-latitudes and arctic in the north. Maritime influences modify both the west and east coast climates, the east coast less, because of the predominantly eastward movement of interior air masses. Permafrost occurs throughout the mid- to northern latitudes. Annual precipitation varies from 50 mm in the far north to as much as 4,000 mm on the Pacific Coast.

The hydrologic and socioeconomic diversity that characterizes Canada makes understanding and managing its water resource and its aquatic environment a great challenge. The federal-provincial/territorial water quantity agreements were developed in response to the needs of water management and environmental issues in each region. Main challenges concern water quality, waste management, water supply, hydro power, floods, trans boundary management, fisheries, tourism, navigation, mining, oil and gas pipelines, fish and wildlife habitat, pollution depending on each province and territory.

[1] http://laws-lois.justice.gc.ca/eng/acts/C-11/page-1.html

[2] http://atlas.gc.ca/site/english/maps/water.html

12.3 Institutional framework

Research

The main organization responsible for developing research and innovation policy is Industry Canada[1], which has overall responsibility for science policy. Other Science-Based Departments and Agencies (SBDAs) which carry out and fund research, such as Agriculture Canada, Natural Resources Canada, Health Canada and Natural Sciences and Engineering Research Council, develop and implement department / agency level research policies specific to their mandate and objectives based on the high level policies identified in Mobilizing Science and Technology to Canada's Advantage. Similarly, federal agencies which fund post-secondary research in universities such as the Natural Sciences and Engineering Research Council also align policies and programs with the high level policies. In many cases, provinces adopt similar policies as the federal government due to co-funding of specific programs and initiatives.

The Government of Canada[2] is the second most important funder of R&D in Canada behind the business sector. In recent years, the largest share of the federal government's expenditures on R&D was allocated to the higher education sector. In addition to R&D, the federal government also supports Related Scientific Activity RSAs[3]. In 2012, RSAs accounted for 36% of the Government of Canada's total expenditures on S&T.

In 2012, the business sector was the largest funder (49%) and performer (52%) of research in Canada[4]. Higher education is the next largest performer of research (38%), receiving funding from internal sources, the federal and provincial governments, industry and the private not-for-profit sector. Federal government funding is used primarily to fund post-graduate students and perform intramural research.

In 2012 the Federal Government provided 4,324 M€ and the provinces 1,245 M€ for R&D funding[5]. The three largest provinces carried out the major quantity of R&D. In 2010, 45% of all R&D was performed in Ontario, 26% in Quebec and 10% in British Columbia.

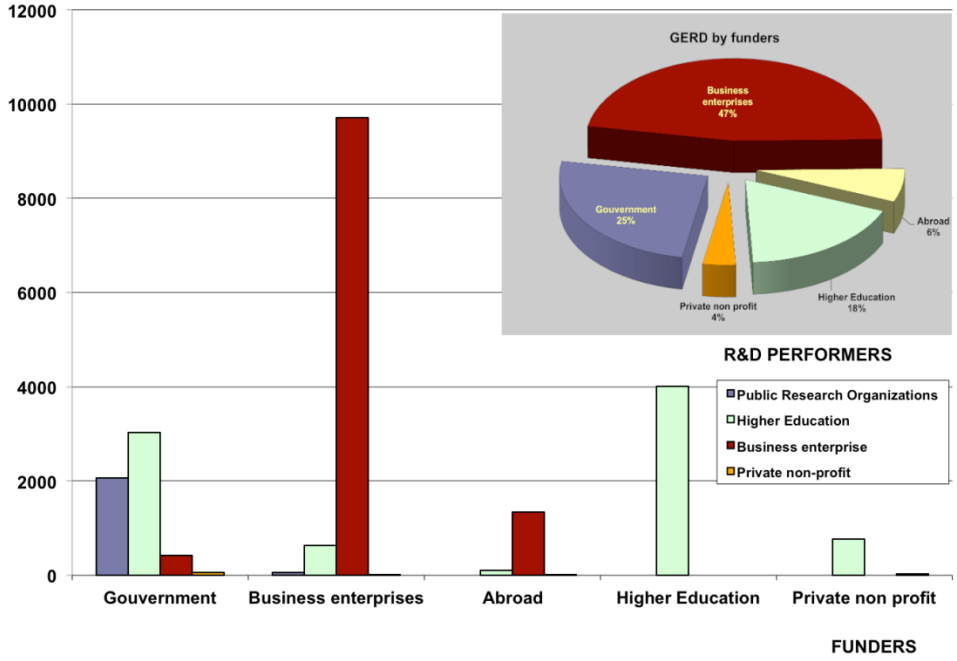
[1] http://www.ic.gc.ca/eic/site/icgc.nsf/eng/home

[2] http://www.science.gc.ca/26E8DF73-CA15-44D3-B3E7-D404BBD0398D/Government.pdf

[3] "Related scientific activities" complement and extend R&D by contributing to the generation, dissemination and application of scientific and technological knowledge

[4] http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ca/country?section=Overview&subsection=FundingFlow

[5] http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ca/country?section=RegionalResearchPolicies&subsection=Overview



Water

The Canada Water Act (1985)[1] provides the framework for the management of the water resources of Canada, including research and the planning and implementation of programs relating to the conservation, development and utilization of water resources

Canada is a federation[2]. When it comes to water governance in Canada, the Federal Government has jurisdiction related to fisheries, navigation, federal lands, and international relations, including responsibilities related to the management of boundary waters shared with the United States, including relations with the International Joint Commission. It also has significant responsibilities for agriculture, health and the environment, and plays a significant role supporting aquatic research and technology, and ensuring national policies and standards are in place on environmental and health-related issues.

Within the federal government, over 20 Departments and Agencies have unique responsibilities for fresh water. As all levels of government hold key policy and regulatory levers which apply to water management, a central challenge is to ensure that these levers are developed and used collaboratively.

Canada's universities are the base for substantial amounts of research into water issues, as are the research facilities of provincial and territorial governments. Departments within Canada's federal, provincial, and territorial governments work individually and collaboratively on an extensive range of issues.

Concerning international dimension[3], programs are related to:

[1] http://laws-lois.justice.gc.ca/eng/acts/C-11/page-1.html

[2] http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=87922E3C-1

[3] http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=B947BAA8-1

- *Shared waters Canada – United States*: Canada and the United States share many waterways, from the Great Lakes, which are among the world's largest bodies of freshwater, to rivers that mark or cross the border between the two countries. These transboundary basins (Figure 8) are home to the majority of the Canadian population, with much of the economy directly dependent on the industrial, agricultural, transportation, and recreational benefits these water resources bring. Canada is a signatory to several treaties and agreements with the United States.
    - The Boundary Waters Treaty of 1909 established the International Joint Commission [1] and set the basic principles for guiding boundary water relations between Canada and the United States.
    - The Great Lakes Water Quality Agreement [2] has been a key instrument for protecting water quality and the health of the aquatic ecosystem in the Great lakes for forty years. The Great Lakes Water Quality Agreement sets out common water quality objectives and commitments, and outlines provisions for the development of cooperative strategies and research. Pursuant to the Boundary Waters Treaty, the first Great Lakes Water Quality Agreement was signed in 1972 and last amended in 2012.

Figure 8 - Canada-United States Transboundary Basins

- *Developing countries and economies in transition*: Canada has two major federal organizations that are dedicated to work with partners in developing countries and economies in transition. The Canadian International Development Agency (CIDA/ACDI) is the lead government organization responsible for Canadian development cooperation. The International Development Research Centre (IDRC) was created "to initiate, encourage, support and conduct research into the problems of the developing regions of the world". Both have substantial experience in working with international partners to address water issues.

[1] http://www.ijc.org/en_/

[2] http://www.ec.gc.ca/grandslacs-greatlakes/ and http://www.binational.net/home_e.html

12.4 Canada, water use and market overview

Water use in Canada 2005[1]				
Public utility water system	Public utility water systems	Self-supplied water system	Total	Share of total water use
	Mm^3			%
Total, all sectors	5,706.2	36,352.1	42,058.3	100.0
Thermal-electric power generation	X	X	27,825.1	66.2
Industry	618.5	5,101.0	5,719.5	13.6
Public supply	3,195.5	575.6	3,771.1	9.0
Irrigation		1,631.7	1,631.7	3.9
Livestock		321.3	321.3	0.8
Commercial and institutional	1,127.8		1,127.8	2.7
Water treatment and distribution Systems	X	X	981.9	2.3
Mining (except oil and gas)	7.5	448.4	456.0	1.1
Oil and gas extraction		224.0	224.0	0.5

In 2005, an estimated 42 km^3 of water were withdrawn from the environment and used in household and economic activities in Canada. About 14% of this water flowed through the public utility water system, and about 86% was extracted from the environment directly by the end user. About 10.5% of the water extracted directly from the environment was not freshwater (either brackish or salt-water), the bulk of which was used by the Thermal-electric power generation sector.

More than 90% of the water that was withdrawn went to support economic activity, and about 9% was used directly by the residential sector. The residential sector used 56% of the water that was supplied by the public utility water system. The sector that used the most water overall, by a considerable margin, was Thermal-electric power generation.

Considering[1] the funds available for infrastructure and the recently drafted national strategy on wastewater management, communities will have the financial capacity to achieve the goals set out in the strategy. Similarly, water management strategies are being developed on a provincial level to discuss, among other things, drinking water. This trend will probably continue with the remaining provinces. The funding available through the federal government will also provide money to invest, expand and upgrade current WTPs.

1 SOURCE: STATISTICS CANADA

Market forecast 2010 Canada[1]	
Total water market: 5247 million USD	
Sector	Share (%)
Utilities	66.8
Industrial water	16.9
Bottled water	11.2
Point of use equipment	4.3
Irrigation equipment	0.8

Market forecast[1]			
Sector (CAPEX)	Time frame	Value (M USD)	Increase / decrease (%)
Drinking water[2]	2007 – 2016	850 - 1300	+ 53
Waste water networks	2007 - 2016	290 - 410	+ 41
Waste water treatment plants	2007 - 2016	130 – 380	+ 192
Industrial expenditure	2007 - 2016	650 – 780	+ 21
Water re use			No data available
Desalination			No data available

[1] SOURCE – GLOBAL WATER MARKET 2011 FROM THE PUBLISHERS OF GLOBAL WATER INTELLIGENCE.

[2] THIS INCLUDES WATER RESOURCES (INCLUDING DESALINATION), WATER DISTRIBUTION NETWORKS (NEW BUILD AND REHABILITATION AND DRINKING WATER TREATMENT PLANTS (NEW BUILD AND REHABILITATION)

12.5 Analyses of Scientific Publications

Population: 35 M inhabitants GDP: 1,329 G €

Research Question	Publications			Publications Respect Europe (%)		
	Number	Per M inhab.	Per G € GDP	Number	Per M inhab.	Per G € GDP
Q1: Ecosystems	4,785	136	4	16	283	**176**
Q2: Citizens	4,303	122	3	13	224	139
Q3: Industry	15,400	438	12	12	216	134
Q4: Bioeconomy	1,376	39	1	10	170	105
Q5: Gap	2,412	69	2	12	217	135
All	18,220	518	14	**14**	247	**153**

The publications produced in Canada in the field of water represent 14% of the European publications. When the number of publications is standardized per GDP, Canada leads, with 153% of the European publications per G€ of GDP. When analyzing Canadian S&T production in the light of the five research questions expressed in the Water JPI SRIA, the main strengths are in the **Ecosystems** area. The rest of sectors follow and show similar intensities, except for the Bioeconomy, which shows less intensity.

During the studied 15-year period, Canada has multiplied its publications by 1.9. This represents 84% of the European increase in the same period. Canada publishes with 137 countries, 32 of which are EU Member States and Associated Countries. The International Cooperation Index is 54% and the European Cooperation Index is 19%.

Who

is publishing with Canada?

In the world	%	In Europe (MS+AC)	%
EU (MS+AC)	18.2	FRANCE	2.9
USA	16.6	UK	2.6
CHINA	4.5	GERMANY	2.2
AUSTRALIA	2.1	SPAIN	1.4
JAPAN	1.1	SWEDEN	1.1

Who

is funding this research?

Funding Agencies	%*
NATIONAL SCI AND ENG RESEARCH COUNCIL OF CANADA, NSERC	57.4
US NATIONAL SCIENCE FOUNDATION	5.3
CANADA RESEARCH CHAIR PROGRAM	4.3
CANADA FOUNDATION FOR INNOVATION, CFI	3.9
NATURAL SCIENCE FOUNDATION OF CHINA	3.6

Which

Institutes are doing the work?

Organizations	%
UNIV ALBERTA	7.4
UNIV BRITISH COLUMBIA	7.1
ENVIRONM CANADA	5.9
AGR AGRI FOOD CANADA	5.8
UNIV TORONTO	5.1

Analysis
per topic:

Who
is leading?

	Organization	%	Authors	%
Q1	UNIV BRITISH COLUMBIA	8.7	BLACK TA	1.8
	ENVIRONM CANADA	7.9	SMOL JP	1.0
	UNIV ALBERTA	7.7	LEAVITT PR	0.9
	UNIV QUEBEC	6.3	CHEN JM	0.9
	UNIV TORONTO	5.7	VINCENT WF	0.9
Q2	UNIV ALBERTA	7.9	HUCK PM	1.5
	UNIV WATERLOO	6.5	PREVOST M	1.4
	UNIV TORONTO	6.4	GAGNON GA	1.3
	UNIV BRITISH COLUMBIA	6.3	RODRIGUEZ MJ	1.3
	ENVIRONM CANADA	6.3	BARBEAU B	1.1
Q3	UNIV BRITISH COLUMBIA	7.0	BLACK TA	0.4
	UNIV TORONTO	6.6	HUANG GH	0.4
	UNIV ALBERTA	6.4	WOOD CM	0.4
	UNIV WATERLOO	5.4	MATSUURA T	0.3
	ENVIRONM CANADA	5.1	RODRIGUEZ MJ	0.3
Q4	AGR AGRI FOOD CANADA	16.5	HUANG GH	1.8
	UNIV GUELPH	10.0	PRASHER SO	1.5
	MCGILL UNIV	7.8	MADRAMOOTOO CA	1.5
	UNIV LAVAL	5.7	CARON J	1.2
	UNIV ALBERTA	5.6	BJORNLUND H	1.1
Q5	UNIV WATERLOO	7.9	HUANG GH	1.7
	UNIV BRITISH COLUMBIA	7.4	SIMONOVIC SP	1.2
	ENVIRONM CANADA	6.7	PIETRONIRO A	1.0
	UNIV ALBERTA	5.8	POMEROY JW	0.9
	UNIV GUELPH	5.4	DINCER I	0.9

12.6 Major RDI programmes

The Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Social Sciences and Humanities Research Council of Canada (SSHRC) are federal granting agencies[1] that support research, research training and innovation in Canadian post-secondary institutions. The Canada Foundation for Innovation (CFI) is a federally funded organization that enables this research, training and innovation through investments in state-of-the-art infrastructure. Together, they enable the creation of research partnerships and the sharing of knowledge between universities, colleges and the private sector. The organizations also provide leadership for Canada's research community, and work to position the future of Canadian research and innovation internationally via the following instruments:

- Co-operative Funding Programs;
- Networks of Centers of Excellence;
- Supporting students;
- Supporting faculty and their institutions; and
- Supporting collaborative research and innovation.

Natural Sciences and Engineering Research Council of Canada

The Natural Sciences and Engineering Research Council of Canada's (NSERC) role is to make investments in people, discovery and innovation to increase Canada's scientific and technological capabilities for the benefit of all Canadians. NSERC invests in people by supporting postsecondary students and postdoctoral fellows in their advanced studies, promoting discovery by funding research conducted by professors and fostering innovation by encouraging Canadian companies to participate and invest in postsecondary research and training. NSERC reports to Parliament through the Minister of Industry.

Over the last 10 years, NSERC has invested more than 7 billion USD in basic research, projects involving partnerships between postsecondary institutions and industry, and the training of Canada's next generation of scientists and engineers.

International research and training are essential components of modern science, technology and innovation. To support and enhance Canada's research and training capacity in the natural sciences and engineering, NSERC has adopted an international strategy[2] that aims to connect Canadian researchers and students with the global supply of ideas and talent. Currently, it is estimated that about five percent of NSERC's annual budget (approximately40 M USD —one-third in scholarship funds and two-thirds in grant funds) is used to directly support international activities. Existing rules governing the use of grant funds facilitate international exchanges and interactions. These are mostly in the form of peer-to-peer collaborations with university-based researchers in five or six countries, particularly the United States.

[1] http://www.science.gc.ca/default.asp?lang=En&n=A0A2F2CB-1

[2] http://www.nserc-crsng.gc.ca/International-Internationale/InternationalStrategy-StrategieInternationale_eng.asp

HFSP 2015 Funding Opportunities: Program and Young Investigator Grants

The NSERC Program Grants are meant to allow teams of independent researchers to develop new lines of research through the collaboration. Several areas of research have been selected, such as Northern Earth System, Material efficiency, Life sciences, and Material research.

Material efficiency, Life sciences and Material research.

G8 Research Councils Initiative on Multilateral Research Funding and Belmont Forum

The Belmont Forum and the G8 Heads of Research Councils (G8-HORCs) are proposing a joint initiative. The Partners Organizations contributing to this International Opportunities Fund and the themes in which they participate are:

Institution Name	Acronym	Country	Freshwater Security M€	Coastal Vulnerability M€
The Commonwealth Scientific and Industrial Research Organization	CSIRO	Australia	In kind*	In kind*
São Paulo Research Foundation	FAPESP	Brazil	1.5	1.0
Natural Sciences and Engineering Research Council of Canada	NSERC	Canada	1.5	N/A
Agence Nationale de la Recherche	ANR	France	1.5	1.5
Deutsche Forschungsgemeinschaft	DFG	Germany	1.5	1.0
Ministry of Earth Sciences, Government of India	MoES	India	0.5	0.5
Japan Science and Technology Agency and Japan Society for the Promotion of Science	JST and JSPS	Japan	0.5	1.5
Russian Foundation for Basic Research	RFBR	Russia	1.0	0.5
National Research Foundation	NRF	South Africa	0.25	0.25
Natural Environment Research Council and Economic and Social Research Council	NERC and ESRC	United Kingdom	1.3	1.5
National Science Foundation	NSF	United States of America	1.0	1.0

In 2012, NSERC funded only new projects on Freshwater Security (coastal vulnerability can be proposed but on own funding) and supported researches in the natural sciences and engineering. Up to 1.95 M CAD (1.5 M€) over three years were available for the period 2013-2016.

NSERC is also participating to call for proposals for industry-led collaborative R&D projects between Canada and Brazil[1], as well as Canada and India[2], together with International Science and Technology Partnerships Canada (ISTP Canada)

NETwork of excellence

Canada's global economic competitiveness depends on making new discoveries and transforming them into products, services and processes that improve the lives of Canadians. To meet this challenge, the Networks of Centres of Excellence (NCE) offers a suite of programmes that mobilize Canada's best research, development and entrepreneurial expertise and focus it on specific issues and strategic areas. NCE programmes meet Canada's needs to focus a critical mass of research resources on social and economic challenges, commercialize and apply more of its homegrown research breakthroughs, increase private-sector R&D, and train highly qualified people. As economic and social needs change, programmes have evolved to address new challenges. Four national programmes[3] bring together the right mix of people and organizations to address important issues for Canadians:

- Networks of Centres of Excellence (NCE) including the
  - NCE Knowledge Mobilization
  - Canada-India Research Centre of Excellence (CIRCE)[4] initiative: The CIRCE initiative strengthens research ties between Canada and India in areas of mutual strategic importance. A network of key researchers and organizations in the two countries builds on existing collaborations to facilitate knowledge mobilization, research exchanges, and partnerships with business and other knowledge users. An example of this type of initiative is the India-Canada Centre for Innovative Multidisciplinary Partnerships to Accelerate Community Transformation and Sustainability – IC-IMPACTS (2012-2017)[5], for a shared vision between Canada and India for healthy, sustainable and prosperous communities by finding solutions to key challenges affecting quality of life. The funding available is 13,8 M USD for the entire funding period
- Centres of Excellence for Commercialization and Research (CECR)
- Business-Led Networks of Centres of Excellence (BL-NCE)
- Industrial Research and Development Internship (IRDI)

Canada foundation for innovation

The Government of Canada (GoC) created the Canada Foundation for Innovation (CFI) in 1997 to build Canada's capacity to undertake world-class research and technology development to benefit Canadians. The infrastructure funded by the CFI includes the state-of-the-art equipment, laboratories, databases, specimens, scientific collections, computer hardware and software, communications linkages and buildings necessary to conduct leading-edge research. CFI funding is awarded to institutions, not individual researchers, and all funding proposals must support an institution's strategic research plan.

[1] http://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/G8-G8_eng.asp

[2] http://www.istpcanada.ca/international_programs/India/index.php

[3] http://www.nce-rce.gc.ca/Programs-Programmes/Index_eng.asp

[4] http://www.nce-rce.gc.ca/Programs-Programmes/CIRCE-CERCI/Index_eng.asp

[5] www.ic-impacts.com

The CFI funds up to 40% of a project's research infrastructure costs. This funding is then leveraged to attract the remaining investment from partners in the public, private and nonprofit sectors. The CFI funding architecture covers the full spectrum of infrastructure: projects to attract a leading researcher; team-led innovative projects that have a structuring effect for an institution or a region; and large-scale national projects. These are:

- Innovation Fund : for the 2015 Innovation Fund[1] (IF) Competition launches a Call for proposals "*Striving for global leadership and reaping the benefits*"
- Major Science Initiatives (MSI) 2014 Special Competition: The CFI will invest up to 25 M USD over three years (approximately 8 M USD per year from 2014-15 to 2016-17) to cover a portion of the total eligible O&M costs of funded facilities.

John R. Evans Leaders Fund: JELF is an allocation-based fund for degree-granting institutions whereby the CFI predetermines the maximum amount of funding available for each eligible institution. Institutions having a minimum annual average of 300,000 USD in sponsored research income (excluding CFI awards) as reported by the Canadian Association of University Business Officers (CAUBO) are eligible to receive a dedicated JELF funding allocation Institutions whose dedicated JELF funding allocation is calculated at less than 400,000 USD will access the Small Institution Fund instead.

- Exceptional Opportunities Fund
- Infrastructure Operating Fund
- Advancing Big Data Science in Genomics Research
- Major Science Initiatives Fund: The 185 M USD that has been allocated to the Major Science Initiatives Fund will cover **a portion of the** total eligible O&M costs of an MSI from 2012-13 to 2016-17.
- Digging Into Data Challenge
- College-Industry Innovation Fund

Environment Canada, Government of Canada

Environment Canada (EC) is protecting the environment, conserving the country's natural heritage, and providing weather and meteorological information to keep Canadians informed and safe. Environment Canada is building on its accomplishments with the environment through credible science, effective regulations and legislation, successful partnerships, and high-quality service delivery to Canadians.

Environment Canada is a diverse organization where programs, services, and people lead the way in implementing the Government of Canada's environmental agenda. Environment Canada's mandate is to

- Preserve and enhance the quality of the natural environment, including water, air, soil, flora and fauna;
- Conserve Canada's renewable resources;
- Conserve and protect Canada's water resources;

[1] http://www.innovation.ca/en/OurFunds/CFIFunds/InnovationFund

- Forecast daily weather conditions and warnings, and provide detailed meteorological information to all of Canada;
- Enforce rules relating to boundary waters; and
- Coordinate environmental policies and programs for the federal government.

Canada also has international environmental obligations under various agreements and fora. The international dimension of Environment Canada's work is important to achieve Canada's international and domestic goals. Environment Canada's international efforts focus on several key issues, including air, biodiversity, chemicals and waste management, climate change[1], enforcement, trade and environment, and water[2].

Water Research

Within Environment Canada, a number of groups play particularly prominent roles in water-related research that benefit all jurisdictions in Canada and many partners internationally. These include:

- National Water Research Institute: Environment Canada's National Water Research Institute (NWRI) is the largest freshwater research entity in Canada. NWRI, National Water Quality Monitoring and staff at Centre Saint-Laurent in Montreal make up the Water Science and Technology Directorate, and work together to generate the scientific knowledge needed to sustain Canada's water resources and freshwater ecosystems. Environment Canada's water scientific and technical knowledge is available here for users of water S&T, including governments, environmental regulators, policy- and decision-makers, land-use planners, researchers, and industry.

- St. Lawrence Centre: The Water Survey of Canada[3] (WSC) is the national authority responsible for the collection, interpretation and dissemination of standardized water resource data and information in Canada. In partnership with the provinces, territories and other agencies, WSC operates over 2800 active hydrometric gauges across the country. In recent years contracts and partnerships with the private sector have expanded the value of the information base and have provided the business sector with highly skilled monitoring expertise and project support. Joint ventures with Canadian consulting firms have taken the agency's expertise to all parts of the globe.

- Environment Canada is responsible for several international activities:
  - In North America:
    - International Gauging Stations
    - International Joint commission
    - North American Commission for Environmental Cooperation
  - Global:
    - World Meteorological Organization

[1] http://climatechange.gc.ca/default.asp?lang=En&n=5497F282-0

[2] http://www.ec.gc.ca/International/default.asp?lang=En&n=0D6528FD-1

[3] http://www.ec.gc.ca/rhc-wsc/default.asp?lang=En&n=4EED50F1-1

  - WMO Hydrological Operational Multipurpose System
  - WMO Hydrology and Water Resources Program
  - WMO Global Runoff Data Centre
- UNESCO International Hydrological Program
- International Association of Hydrological Sciences

Foreign affairs, trade and development Canada –Government of Canada

As part of its Aid Effectiveness Agenda, the Government of Canada announced in 2009 that it will be focusing 80% of bilateral resources in 20 countries of focus. These 20 countries were chosen based on their real needs, their capacity to benefit from aid, and their alignment with Canadian foreign policy priorities. (see figure 9)

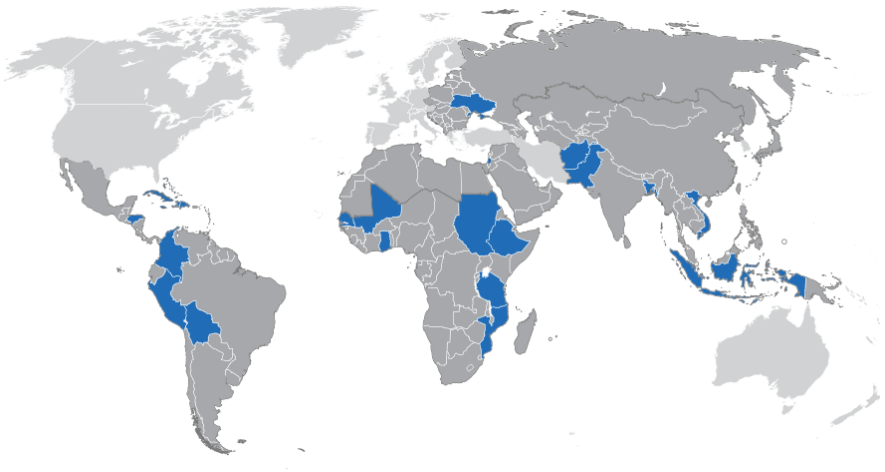


Figure 9 - Focus countries Canada

Researchers and students pursuing international development research work at a university in Canada or in a developing country may apply for funding from the International Development Research Centre (IDRC).

United Nations University – Institute for Water, Environment and Health - Institute

This grant (max 2 M USD for 2007-2011) represents Canada's institutional support to the United Nations University Institute for Water, Environment and Health (UNU-INWEH)[1]. UNU-INWEH uses these funds, along with other donors funding, to achieve its mandate.

UNU-INWEH's mandate is to contribute, through capacity development and directed research, to efforts to resolve pressing global water problems that are of concern to the United Nations, its member states and their peoples. UNU-INWEH acts as the "UN Think-Tank on Water". It responds directly to global water issues and supports efforts to meet the Millennium Development Goals.

The sectors covered are:

- Improving health

[1] http://inweh.unu.edu/

  - Education and training in water supply and sanitation (014081): 30%
  - Basic drinking water supply (014031): 20%
  - Basic sanitation (014032): 20%
- Environment
  - Water resources conservation (including data collection) (014015): 20%
  - Water sector policy and administrative management (014010): 10%

IDRC - The International Development Research Center

The International Development Research Centre (IDRC) is a Canadian Crown corporation established by an act of Parliament in 1970 to help developing countries find solutions to their problems. IDRC often works with other Canadian government departments and agencies on programmes of mutual interest. Most of IDRC's funding comes from annual appropriations from Canada's Parliament. IDRC also receives funds from other sources, such as foundations and other Canadian and international organizations that support international development or fund research.

The head office is in Ottawa, Canada.Four regional offices are located in Montevideo (Uruguay). Cairo (Egypt), Nairobi (Kenya), and New Delhi (India).

- They manage local research programs;
- Monitor risk and provide stewardship of the Centre's local resources;
- they represent and promote IDRC in diplomatic, political, and international fora; and
- they link Canadians with important scientific communities abroad.

IDRC's main internal research divisions are designed to tackle broad development issues[1]:

- Agriculture and Environment deals with concerns about food security, climate change and water, ecosystems and health, and environmental economics.
- Global Health Policy addresses access to health care, health information systems, and the understanding and control of chronic diseases.
- Science and Innovation seeks to reduce poverty through new technologies and the application of science and innovation.
- Social and Economic Policy informs key public policy issues that will promote inclusive growth, accountable government, and public security

IDRC promotes and sustains linkages with Canadian institutions, particularly universities and civil society organizations. IDRC also funds and administers Corporate Awards and International Fellowships programs for emerging and mid-career researchers in Canada and in developing countries.

The Strategic Framework 2010-2015[2] underlines "Agriculture and the Environment" as one of the priorities. This will be addressed through the lens of:

- Health and the environment, with an emphasis on building the field of eco health;
- Sustainable agriculture and food security, to ensure that the poor benefit from new technology,

[1] Briefing notes (August 2013)

[2] http://www.idrc.ca/EN/AboutUs/WhatWeDo/Documents/12652071211Strat_FrameworkExSum.pdf

- markets, and policies, and provide fresh options for producers and consumers;
- Adaptation to climate change by increasing resilience and identifying clean development options; and
- Energy supply and use, including policy options and the promotion of sustainable energy technologies.

IDRC is a Crown corporation, and most of its funding comes from an annual appropriation made to it by Canada's Parliament. In 2012-2013, IDRC received 157.5 M CAD in such revenues. This money represents approximately 78% of IDRC's budget for the year, and 3% of Canada's international assistance.

IDRC is permitted also to receive funds from collaborating agencies, such as philanthropic foundations and other organizations that support international development or that fund research. The balance of IDRC's revenues comes mainly from such sources, in Canada and in other countries: in 2012-2013, IDRC was involved in 22 donor contribution agreements with 10 donor partners, worth 302.8 M CAD at signature.

These donor partners include the Bill & Melinda Gates Foundation, the William and Flora Hewlett Foundation, Foreign Affairs, Trade and Development Canada, and the United Kingdom's Department for International Development, among others. In recent years such collaborations have been growing, and are a measure of the respect IDRC possesses in the development community.

During 2012-2013, IDRC spent 271.0 M CAD on development research programs, and 22.1 M CAD on corporate and administrative services.

The Canadian trade commissioner service

Web site: http://www.tradecommissioner.gc.ca/eng/home.jsp?rd=f

Foreign Affairs, Trade and Development Canada, along with the Government of Canada, provide funding programmes to help take businesses to the next level.

ISTPP – International Science and Technology Partnerships Program

Mandated by the Government of Canada through Foreign Affairs, Trade Development Canada (DFATD), ISTPCanada develops and implements R&D collaboration programs under Science and Technology (S&T) cooperation agreements between Canada and its key trading partners, including India (2005), China (2007), Brazil (2008) and Israel (2011). ISTPCanada:

- Stimulates early-stage partnership development activities;
- Facilitates the creation of new partnerships between Canadian companies, research organizations and their counterparts in other countries; and
- Invests in cooperative R&D projects with high commercial potential.

The International Science & Technology Partnerships Program (ISTPP) was renewed by the Government of Canada in Budget 2010 to promote international collaborative research and development. The five-year, $20-million program will allow to foster and support bilateral research projects with potential for commercialization between Canada and partner countries. It will also stimulate bilateral science and technology networking and matchmaking activities to further new partnerships and accelerate the commercialization of research and development. The ISTPP is a "seed fund", meaning that various other public and private sector participants are also encouraged to bring S&T expertise and funds of their own to the bilateral relationship.

DFATD has selected International Science and Technology Partnerships Canada (ISTPPCanada) as the delivery organization for the India, China and Brazil components of the ISTPP. ISTPCanada is a not-for-profit arms-length organization incorporated in Canada which will support up to 50% of the costs of approved joint research projects proposed by companies and other private sector research and development organizations. In addition, ISTPPCanada will conduct partnership development activities to support upcoming calls for proposals.

The Canada Israel Industrial Research & Development Foundation (CIIRDF) is the delivery organization for the Israel component of the ISTPP. CIIRDF is an arms-length bilateral organization incorporated in Canada to foster and support bilateral industrial research projects between Canadian and Israeli companies and supports up to 50% of the costs of approved joint research projects. CIIRDF also organizes and delivers a number of "match-making" events designed to bring together Canadian and Israeli companies to explore partnership opportunities. Funding from each country is provided annually to the Foundation.

Calls for Proposals (CFPs) for collaborative R&D with identified countries will be announced periodically conditional on the funding processes of the partner country. ISTPCanada and CIIRDF are responsible for issuing the Calls for Proposals in Canada. To have the most up-to-date information on upcoming calls and procedures please visit these web sites on a regular basis: ISTPCanada; CIIRDF

GGI – Going Global Innovation

Going Global Innovation (GGI) is a funding program created by Foreign Affairs and International Trade Canada (DFAIT) to stimulate international research and development (R&D) partnerships that benefit Canadian innovators. GGI provides Canadian small and medium-sized companies, post-secondary institutions and non-government research and innovation centers with 5,000 USD to 75,000 USD to support in-person meetings and related activities to solidify an international R&D partnership.

Once established, these global alliances enable the partners to combine their complementary technologies, expertise and resources for the joint development of new products with high commercial potential. Downstream, the emerging innovations are promoted and sold to customers in target markets around the world, stimulating new commercial activity, trade and exports for all collaborators.

Going Global Innovation is one of three funding programs that comprise the Global Commerce Support Program (GCSP) managed by DFAIT. An integral element of the Global Commerce Strategy established by the Government of Canada, GCSP aims to help position Canada as a world leader in the highly competitive global economy.

As example, GGI helps Canadian firm collaborate with China to improve water quality[1]. Researchers at Fleming College in Lindsay, Ontario aimed to evaluate and further develop water technologies created by Aqua Treatment Technologies of St. Catherine's, and demonstrate how these innovations through joint R&D projects with Chinese researchers, could improve water quality in China.

Social Sciences and Humanities Research Council

The Social Sciences and Humanities Research Council of Canada (SSHRC) is the federal research funding agency that promotes and supports postsecondary-based research and training in the humanities and social sciences. Created by an act of Canada's Parliament in 1977, SSHRC reports to

[1] http://www.tradecommissioner.gc.ca/eng/funding/ggi/document.jsp?did=136746

Parliament through the Minister of Industry. SSHRC also invests directly in Canada's future. Through the social sciences and humanities, students receive the best possible training in critical thinking, complex decision-making and creative exploration. By investing in scholarships, fellowships and research training, SSHRC helps develop Canada's best and brightest scholars and researchers into Canada's future leaders.

SSHRC-funded research by theme[1] (new and ongoing projects)

SSHRC-funded research	Number of projects	Amount (in M USD)	Funding (%)
Environmental science and technologies	441	24,154,234	7.2
Natural resources and energy	38	2,055,257	0.6
Health and related life sciences and technologies	86	13,360,205	4.0
Information and communications technology	545	21,571,398	6.4
Management, business and finance	623	19,917,572	5.9
Arts and culture	1,639	53,023,613	15.7
Economy, employment and markets	674	29,744,415	8.8
Education and learning	781	29,443,974	8.7
Human development	605	22,836,549	6.8
Social development	1,756	65,660,452	19.5
Governance of society and institutions	986	35,236,631	10.5
Other areas of research	500	20,007,590	5.9
TOTAL	**8,674**	**337,011,891**	**100**

Canada Research Chairs

The Canada Research Chairs Programme stands at the center of a national strategy to make Canada one of the world's top countries in research and development. In 2000, the Government of Canada created a permanent program to establish 2000 research professorships —Canada Research Chairs— in eligible degree-granting institutions across the country.

Since 2006, the Government of Canada has provided more than 11 billion USD in new resources to support basic and applied research, talent development, research infrastructure and innovation in the private sector. Ongoing annual program expenditures of 265 M USD have helped attract and retain some of the world's most accomplished and promising minds.

There are more than 1,700 chair holders working in the fields of natural sciences and engineering, health, and social sciences and humanities at more than 70 post-secondary institutions across the country. They strengthen Canada's international competitiveness, and help train the next generation

[1] http://www.sshrc-crsh.gc.ca/about-au_sujet/facts-faits/index-eng.aspx

of highly skilled people through student supervision, teaching, and the coordination of other researchers' work.

The University of Alberta, a center of research excellence in Canada, is home to nearly 100 Canada Research Chairs and three Canada Excellence Research Chairs.

Chair holders aim to achieve research excellence in engineering and the natural sciences, health sciences, humanities, and social sciences. The Canada Research Chairs Secretariat, which is housed within the Social Sciences and Humanities Research Council, is responsible for the day-to-day administration of the program. It reports to the Management Committee, which itself reports to the Steering Committee. The Steering Committee reports to the Minister of Industry.

In addition to playing an important role in the peer-review process, the Steering Committee is mandated to oversee the management of the program and to provide strategic advice on the program's general direction. The members of the Steering Committee are from:

- Social Sciences and Humanities Research Council
- Natural Sciences and Engineering Research Council
- Canadian Institutes of Health Research
- Canada Foundation for Innovation
- Industry Canada
- Health Canada

National Research Council

The National Research Council (NRC) is the Government of Canada's premier research and technology organization (RTO). NRC encourages and engages in multiple forms of collaboration for a project. The collaborative research projects span a very broad spectrum of activities and business structure models.

New innovation advantage for Canadian companies is provided by participating to EUREKA through access to technology, expertise, and markets in Europe and beyond. EUREKA is an international network for market-driven industrial R&D that includes over 40 economies from the EU, Europe, Israel, South Korea, and now Canada. NRC is the national contact point for EUREKA.

The trusted advisory services and technological expertise provided by the industrial technology advisors are a fundamental component of NRC's Industrial Research Assistance Program (IRAP). Through its industrial technology advisors, IRAP offers financial assistance to eligible firms, eg. small and medium-sized enterprises, under different programs, such as Technology innovation projects and Youth employment strategy programmes.

NRC Ocean, Coastal and River Engineering (NRC OCRE) supports a broad cross section of industry sectors by developing creative and practical solutions to engineering challenges in rivers, lakes and marine environments. It provides expertise and tools to identify, adapt, and integrate advanced solutions into systems that improve the performance and safety of ocean, coastal, and marine operations, meet the challenges of climate change, and protect infrastructure, property and people from severe weather events and other environmental risks.

12.7 Connection between Water JPI SRIA and the RDI programmes and policies of Canada

SRIA Questions	Rate (1 to 6)	Brief motivation of the rating
Sustainable ecosystems	5	Preservation of fish and wildlife habitats, soil erosion and nutrient losses, flood forecasting are recognized as important water issues. Transboundary water management is treated since more than 100 years with US.
Developing safe water systems for the citizens	3	Large freshwater resources and low population are encountered but some provinces have issues with municipal and industrial supply, urban drainage systems.
Promoting competitiveness in the water industry	6	Large efforts are provided by Canada to develop industrial partnership. These existing programs could provide valuable platforms for joint activities
Implementing a water-wise bio-based economy	4	Water quality, waste management, toxic chemicals and agricultural pollution is a concern, also related to mining and oil industry.
Closing the water cycle gap	3	Integrated water management is in force with close to 9% of the world's renewable water supply. Ice and glacier evolution still needs to be studied (in the perspective of climate change)

12.8 Acronyms of CANADIAN Institutions and reference documents

Acronym	Institution Name	Website
CFI	Canada Foundation for Innovation	http://www.innovation.ca/en
CIDA	Canadian International Development Agency	http://www.acdi-cida.gc.ca/acdi-cida/acdi-cida.nsf/eng/home
CIIRDF	Canada Israel Industrial Research and Development Foundation	http://www.ciirdf.ca/home/index.php
CIRCE	Canada-India Research Centre of Excellence	http://www.nce-rce.gc.ca/Programs-Programmes/CIRCE-CERCI/Index_eng.asp
DFATD	Foreign Affairs, Trade Development Canada	http://www.tradecommissioner.gc.ca/eng/home.jsp?rd=f
EC	Environment Canada	http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=65EAA3F5-1
GGI	Going Global Innovation	http://www.tradecommissioner.gc.ca/eng/funding/ggi/ggi.jsp
GoC	Government of Canada	http://www.canada.ca/en/index.html
IDRC	The International Development Research Centre	http://www.idrc.ca/EN/Pages/default.aspx
IF	Innovation Fund	http://www.innovation.ca/en/OurFunds/CFIFunds/InnovationFund
IRAP	Industrial Research Assistance Program	http://www.nrc-cnrc.gc.ca/eng/irap/index.html
ISTPP	International Science and Technology Partnerships Canada	http://istpcanada.ca/home/
NCE	Centres of Excellence	http://www.nce-rce.gc.ca/About-APropos/Index_eng.asp
NRC	National Research Council	http://www.nrc-cnrc.gc.ca/eng/index.html
NSERC	Natural Sciences and Engineering Research Council of Canada	www.nserc-crsng.gc.ca
NWRI	**National Water Research Institute**	http://www.ec.gc.ca/INRE-NWRI/Default.asp?lang=En&n=7CE9E3AC-1
SSHRC	Social Sciences and Humanities Research Council of Canada	http://www.sshrc-crsh.gc.ca/about-au_sujet/index-eng.aspx
UNU-INWEH	United Nations University Institute for Water, Environment and Health	http://inweh.unu.edu/

13. VIETNAM

13.1 Context and RDTI

Vietnam's population totals to over 86 million with an estimated GDP per capita of $3100. Vietnam is the 13th most populous country in the world and almost two-thirds of its people live along the country's three main river basins- Thai Binh, Mekong Delta and Dong Nai. GDP registered a growth of 5.4 percent[1] year over year.

A major contribution in financing RDI with Vietnam is coming from Europe (28,3 %) and Japan (6,3 %)

For Vietnam the European Union is the second biggest trade partner after China. At present Vietnam and the EU are in negotiation for a Free Trade Agreement. It is expected to be concluded at the end of 2014.[2]

Since Vietnam intends to develop to an industrial country until 2020[3] an increased demand for technology and innovative is to be expected.

After making the transition to a market-oriented system in 1986 the economy has steadily risen which had negative impacts to the environment and the natural resources such as water, soil and air[4] Due to its location Vietnam is endangered by sea-level rise, salt water intrusion, flooding and natural hazards such as typhoons.[5]

The Government of Vietnam has made impressive gains in tackling the management of water resources in the country. This has been made possible through a rise in public investments in the water sector to 8,621 bill. VND in 2001 from 5,682 bill. VND in 1996.

13.2 Water Challenges[6]

Vietnam has a dense river network —2,360 rivers with a length of more than 10 km. Eight out of these are large basins with a catchment area of 10,000 km² or more. This river network includes many international rivers that originate in catchments in other countries. About two thirds of Vietnam's water resources originate outside the country, making Vietnam susceptible to water resources decisions made in upstream countries.[7]

The total area in- and outside Vietnam of all international catchments is close to 1.2 M km², which is approximately three times the size of Vietnam itself. The total annual runoff is 835 billion m³ but the shortage of water is aggravated in the 6-7 month dry season when the runoff is only 15 to 30% of this total.

All the rivers traversing Vietnam provide an abundant supply of water (255 billion m³ annually). However, inadequate physical infrastructure and financial capacity results in a low utilization of only

[1] Deloitte

[2] AA2 (2014)

[3] UBA (2013)

[4] ADB (2010)

[5] UBA (2013)

[6] Source: WEPA

[7] Water Sector Review (2009)

53 billion m³ per year. In addition, the uneven distribution across Vietnam of the average annual rainfall of 1,960 mm and the prolonged dry season result in serious shortages of water in many areas.

Groundwater resources are abundant with the total potential exploitable reserves of the country's aquifers estimated at nearly 60 billion m³ per year. However, despite the abundance of groundwater reserves, less than 5% of the total reserves are exploited for the country as a whole. In some areas, over-exploitation has resulted in falling water tables which contributes to further land subsidence and salinity intrusion, especially in the Mekong River Delta.

Water utilization: In Vietnam, irrigation places the largest burden on water resources. Total irrigation demand in 2000 was 76.6 billion m³, representing 84% of total demand. Since 1998, total irrigated area has increased annually by 3.4% on average, but the irrigation systems can serve only 7.4 M ha (or 80% of total cropped land). The government expects irrigation demand to increase to 88.8 billion m³ by 2010, (representing an irrigated area of 12 M ha).

Clean drinking water is now provided to 60% of Vietnam's population. The Governments strategy is to increase this to 80% in 2005 and the urban coverage to 95% in 2010. Fisheries, aquaculture, industries and services also make increasing demands on the country's water resources.

Water quality: There is increasing evidence of pollution of Vietnam's surface, ground and coastal waters. Although the quality of upstream river waters is generally good, downstream sections of major rivers reveal poor water quality and most of the lakes and canals in urban areas are fast becoming sewage sinks. Groundwater shows pockets of contamination and some salinity intrusion. Rapid urbanization and industrialization in coastal areas, port and marine transport development, expansion in coastal tourism, and an increase in the number of oil spills contribute to the deterioration of coastal water quality.

Vulnerability: The geography and topography of Vietnam makes the country extremely vulnerable to natural hazards. Heavily populated areas such as the Delta Regions of the Red River and the Mekong River along with the Central Coastal Regions are especially vulnerable to natural disasters. Each year natural disasters such as typhoons, storms, floods or drought have extreme effects on people, their livelihood, their agricultural lands, their livestock, and their infrastructure.

Challenges: To achieve the vision and targets of managing the country's vast water resources in a sustainable way, Vietnam needs to address the following key challenges:

- Strengthening the policy and institutional framework for integrated water resources management;
- Expanding and diversifying investment in infrastructure for the water sector, while paying more attention to financing for the management side;
- Improving compliance and enforcement;
- Deepening public participation and involvement.

The core issues in tackling these challenges are adopting an integrated river basin approach, greater and more sufficient adaptation to the water-related vulnerability and susceptibility, expanded and more efficient services for irrigation and domestic water supply, and curbing water pollution and its health impacts on the poor.

More proactive engagement in regional riparian cooperation, improving information management, complete separation of the water management and service functions, further decentralization of management authorities, and strengthening of institutional capacity would provide Vietnam with the required management tools that will address equity, efficiency and environmental sustainability of Vietnam's water resources.

13.3 Institutional framework

In Vietnam the water sector has no overall integrated strategy and action plan at the national or regional basin level. However, strategies and action plans exist for a number of the sub sectors. The Law on Water Resources, approved in 1998, represents a major step toward integrated water resources management. In 2000 a National Water Resource Council at the national level and in 2001 three Boards for River Basin Planning and Management at a local level were established to work under the government as advisory, coordination and planning bodies.

With the creation of a new Ministry of Natural Resources and Environment (MONRE) in 2002, the state management of water resources was allocated to the Agency of Water Resources Management within MONRE. This important change represents a separation of state management and service functions for water resources. Previously, both water resources management and service functions were the responsibility of the Agency of Water Resources and Hydraulic Works Management under MARD (Ministry of Agriculture and Regional Development).

Backed by increased investments, and improved capacity, the Government of Vietnam has formulated and implemented several policies and programs that specifically address issues relating to water resources management. These issues include improving access to clean water and sanitation; curbing pollution; conserving biodiversity and protecting ecosystems; improving the sustainability of fisheries; addressing vulnerability to water-related disasters; and strengthening river basin management.

The Ministry of Science and Technology is the major funding organization for water RDI in Vietnam. It is a governmental agency which performs functions of State management on Science and Technology, including Science and Technology activities; development of Science and Technology potentials; intellectual property; standards, metrology and quality control.

Water resources management is spread to many ministries. An overview is given in the table 1.

Ministry	Field of responsibility
MoNRE Ministry of Natural Resources and Environment	Water resources, planning and management, surveillance and monitoring, water rights, legal principles
MARD Ministry of Agriculture and Rural Development	Irrigation and drainage of agricultural areas, water supply and sanitation in rural areas
MoC Ministry of Construction	Water supply and wastewater treatment in urban areas, planning of facilities in urban areas, land use planning
MoIT Ministry of Industry and Trade	Hydro-electric power stations, planning, construction; industrial wastewater waters
MPI Ministry of Planning and Investment	Strategies, planning and approvals
MoH Ministry of Health	Health standards, potable water quality
MoST Ministry of Science and Technology	Management of research and development in the area of water resources

Ministries of the water sector in Vietnam. Based on the compilation by UBA (2013).

13.4 Vietnam, water use and market overview[1]

Vietnam		
Annual withdrawal (1992)	100%	54.3km^3
Domestic (1987)	4%	2.17
Industrial (1987)	10%	5.43
Agriculture (1987)	86%	46.7

A 73% of urban households in 2004 had access to piped water. In the major cities, 80% of households have access to piped water or private wells. Average urban water consumption is 50-70 L per capita per day. About 34% of households are either connected to the sewerage system or have septic tanks. Other households either share facilities or use latrines, with 92% having adequate service in 2004.

Vietnam is seeking to spend some 1billion USD on reaching 85% safe water coverage by 2010 and 100% coverage by 2020. In March 1999, a decree was passed seeking to have 60-80% of urban sewage and storm waters connected to a sewerage network by 2020, with 90-100% coverage in Hanoi, Ho Chi Minh City and other major cities and industrial zones. The Government expects this to be self-funded through payments from the public and industry. The intention is to create a series of non-profit urban drainage public service corporations. Between 1999 and 2005, the focus was on developing storm sewerage systems for Hanoi and Ho Chi Minh City. Currently state and international investment is running at 0.6 USD per capita pa against an estimated need of 15 USD per capita pa. These plans are based on uniform tariffs introduced in 1999 with the long term aim of cost recovery, devolving water management to the municipal level and a more positive approach to the private sector as agreed at the 10th Party Congress in 2006. In 2004 drinking water distribution was classified as a commercial activity. Particular issues are 21-44% distribution losses in the largest cities, intermittent supplies in some cities and the need to raise investment in water from 0.6% of GDP to 1.2% of GDP for the 2010 plans (ADB, 2007).

In Hanoi, water loss is increasing (currently 160,000 m^3/day) while the source is being depleted —the groundwater level is dropping by 1.0 m/year. By 1994, 32% of total production was billed. The 68% of water unaccounted for comprised 43% typically referred to as distribution losses, 20% identified leakage, and 5% for the water company's own use. The volume of billed water is currently decreasing, despite the repair of 1000 leaks/year and disconnection of 2000 illegal connections each year. It is therefore assumed that the rate of increase of illegal connections is greater than the rate of leak repair. Consumer studies are seen as an immediate requirement to identify or address consumer waste, illegal connections, tariff charges, and consumer contracts. Currently, 50% of Hanoi's 200,000 customers have contracts for revenue payment. The Hanoi water sector was reorganised in early 1994 into a new company the Hanoi Water Business Company, whose business aims are to have 100% of consumers registered, all with meters and at least 85% of water costs recovered through tariff collection, supported by a 24 hour service level.

[1] SOURCE – GLOBAL WATER MARKET 2011 FROM THE PUBLISHERS OF GLOBAL WATER INTELLIGENCE.

13.5 Analyses scientific publications

Population: 90 M inhabitants GDP: 114 G €

Research Question	Publications			Publications Respect Europe (%)		
	Number	Per M inhab.	Per G€ GDP	Number	Per M inhab.	Per G€ GDP
Q1: Ecosystems	126	1	1	0.4	3	54
Q2: Citizens	186	2	2	0.5	4	70
Q3: Industry	253	3	2	0.2	1	26
Q4: Bioeconomy	94	1	1	0.7	5	**84**
Q5: Gap	117	1	1	0.6	4	76
All	487	5	4	**0.4**	3	**48**

The publications produced in Vietnam in the field of water represent 0.4% of the European publications. When the number of publications is standardized per GDP, Europe leads (Vietnam is 48% of Europe). When analyzing Vietnamese S&T production in the light of the five research questions expressed in the Water JPI SRIA, the main strengths are in the **Bioeconomy** area. The rest of sectors follow and show similar intensities, except for the Industry sector (clearly lower).

During the studied 15-year period, Vietnam has multiplied its publications by 7, which represents an important increase rate, 284% of the European increase in the same period. Vietnam publishes with 54 countries, 21 of which are EU Member States and Associated Countries. The International Cooperation Index is 139%, and the European Cooperation Index is 60%.

Who

is publishing with Vietnam?

In the world	%	In Europe (MS+AC)	%
EU (MS+AC)	60.8	FRANCE	8.8
JAPAN	21.6	DENMARK	8.2
USA	8.0	BELGIUM	7.6
AUSTRALIA	7.4	NETHERLANDS	7.6
THAILAND	6.8	GERMANY	7.4

Who

is funding this research?

Funding Agencies	%*
MINISTRY OF FOREIGN AFFAIRS OF DENMARK	16.3
EU	7.6
VIETNAMESE MINISTRY OF SCIENCE AND TECHNOLOGY MOST	6.5
JAPAN SOCIETY FOR THE PROMOTION OF SCIENCE JSPS	6.5
IRD	4.3

Which

Institutes are doing the work?

Organizations	%
CANTHO UNIV	10.9
VIETNAM ACAD SCI TECHNOL	8.0
VIETNAM NATL UNIV	4.3
HANOI UNIV SCI	4.1
UNIV COPENHAGEN	4.1

Analysis

per topic:

Who

is leading?

	Organization	%	Authors	%
Q1	CANTHO UNIV	11.1	JOUQUET P	6.3
	EHIME UNIV	6.3	OMORI K	4.0
	HANOI UNIV SCI	5.6	BOTTINELLI N	3.2
	IRD	5.6	HAMAOKA H	3.2
	VIETNAMESE ACAD SCI TECHNOL	5.6	LARSEN F	3.2
Q2	NATL INST HYG EPIDEMIOL	11.3	VIET PH	10.8
	HANOI UNIV SCI	10.8	BERG M	9.1
	VIETNAM ACAD SCI TECHNOL	8.1	KAY BH	5.4
	UNIV QUEENSLAND	5.9	TRANG PTK	5.4
	EHIME UNIV	5.4	RYAN PA	4.8
Q3	CANTHO UNIV	7.5	VIET PH	5.5
	HANOI UNIV SCI	5.9	TANABE S	3.2
	VIETNAM NATL UNIV	5.9	BERG M	2.8
	HANOI UNIV TECHNOL	5.5	PHUONG NT	2.8
	VIETNAMESE ACAD SCI TECHNOL	5.5	TUYEN BC	2.4
Q4	CANTHO UNIV	16.0	PHONG LT	5.3
	WAGENINGEN UNIV	10.6	VIEN TD	5.3
	KATHOLIEKE UNIV LEUVEN	6.4	KOTERA A	4.3
	KYUSHU UNIV	6.4	NHAN DK	4.3
	NATL INST AGROENVIRONM SCI	6.4	PHONG TK	4.3
Q5	CANTHO UNIV	6.8	KAY BH	3.4
	NATL INST HYG EPIDEMIOL	6.0	RYAN PA	3.4
	INST PASTEUR	4.3	BERG M	2.6
	HANOI UNIV SCI	3.4	KIM KW	2.6
	INT RICE RES INST	3.4	NAM VS	2.6

13.6 Major RDI programmes

The Ministry of Science and Technology has elaborated a Strategy for Science and Technology Development for the 2011-2020 period". The strategy has been approved in 2012. It centers the development of science and technology together with education and training as the top national policies and key motivations for the country's fast and sustainable development. It shall support the competitiveness of the economy and speed up the country's industrialization and modernization.

There are several issues related to water, technology and resources management mentioned in the strategy: [1]

- study and identify the nature, causes and impacts of natural disasters and processes of climate change to be the basis for proposing and implementing solutions to mitigate, prevent and adapt to climate change, especially impacts of sea water rising phenomena,
- develop waste water, solid wastes, hazardous wastes and exhaust gas treatment technologies with functions and costs suitable to Vietnam's conditions. To apply clean production technology and environmental-friendly technology in production and business in order to minimize gas emissions caused by greenhouse effects, apply modern technology in basic surveys, safe and efficient management and use of natural resources in linkages with environmental protection, including land, water and mineral resources, biological resources and marine resources, to improve technological capacities for forecasting, observing, preventing, responding to and overcoming environmental incidents.

The most important research programme in Vietnam where water issues are included is the "**Program KC08: S&T R &D program for prevention of natural disasters, environmental protection and consequent use of natural resources."** The programme owner is the Ministry of Science and Technology.[2]

Nearly each project of the research programme is in cooperation with a foreign country and is co-financed from the Vietnamese side.[3]

In Vietnam the total R&D funding volume is about 600 mio. USD, whereof an estimated 200 mio. USD are assigned to water and sustainability including green production and business development. Personnel expenses of public institutions (such as ministries) are directly funded by the Ministry of Finance of Vietnam. Therefore only a third is budgeted with MoST. In smaller provinces and cities there is not much research activity. Approximately 10% of MoST funding volume is used for these areas. In total it is assumed that ca. 70 mio. USD on R&D in water and sustainability are spent by MoST.[4]

Vietnam Academy for Science & Technology (VAST)

The Vietnam Academy for Science and Technology is a large national university in Vietnam. It was founded in 1975. VAST realises the basic functions of studying natural sciences and developing technologies based on key orientations by the State. VAST is a leading scientific and technological agency of the country, plays a leading role in the national scientific and technological system, and

[1] MoST (2014)

[2] MoST 1 (2014)

[3] MoST 1 (2014)

[4] MoST 2 (2014)

conducts basic research on natural sciences and comprehensive and high-standard technological development.

International co-operation and assistance are integral parts of science and technology development. VAST has closed relationship with many scientific institutions from Europe e.g. France, Germany, Italy, Spain and England.[1]

Vietnam Institute for Water Resources Research (VIWRR)

The Vietnam Institute for Water Resources Research VIWRR has founded in 1959 and has the following functions:

- Scientific research on water resources;
- Construction and technologies transfer;
- Postgraduate training: and
- Technical Consultancy on water resources.

Sectors of scientific and technological research are:

- River training, coastal protection, flood control and natural disaster mitigation;
- Water Resources and Water Environment protection;
- Irrigation, drainage, land reclamation, and water supply;
- Construction, upgrading and protection of hydraulic, hydroelectric works;
- Water resources Economy and Policy: and
- Specialized Equipment, automatization and software technologies.

The institute has the total staff of 800 persons with 46 doctors and 52 masters. The Center for Water Resources Software consists of 4 groups:

1. Development and Application of software;
2. GIS and Remote sensing, Automatic;
3. Control of Water Supply systems; and
4. Consultancy and Service for Information Technology.

The list of project, carried out by VIWRR:

1. Water management by electrical pump in the red river delta, 1995-1997, funded by ACIAR.
2. Consultant works for monitoring and evaluating effect BME -The ADB2 water resources project for the red river delta, 1999-2002.
3. The Day River flood diversion and water resources development, 2001-2002, funded by the Netherlands.
4. Water resources measures for eliminating hunger and reducing poverty, 2001-2002, funded by IWMI.
5. Water management for irrigation systems, 1999-2003, funded by ACIAR.
6. Improvement the capacity of research institute in the water field, 2001-2004, funded by Denmark.

Cooperation with the Netherlands

The Netherlands is building partnerships with other delta regions in the world and Vietnam is one of the countries with a long history of collaboration in the field of water and coastal zone management.

In October 2009, the Vietnamese MARD, MoNRE and the Dutch MIE (Ministry of Infrastructure and Environment) signed a Memorandum of Understanding (MoU) for cooperation until 2015.

[1] Swap and Transfer, http://www.swap-transfer.eu/vietnam-academy-of-science-and-technology.html. April 2014

Participants agree to broaden the existing cooperation in the field of integrated river basin management and coastal zone management between Vietnam and the Netherlands, into a long-term cooperation based on equality and mutual benefit. Parties agreed on concentrating their cooperation at the Mekong Delta and the Vietnam Southern Key Economic Zone (SKEZ).

In January 2010 the MoU was followed by a formal request from the Government of Vietnam for assistance of the Netherlands in developing a Delta Plan for the Mekong Delta. In the Strategic Partnership Arrangement between Vietnam and the Netherlands on Climate Change Adaptation and Water Management (October 2010), the two countries explicitly agreed to "*closely cooperate on developing an integrated long-term Mekong Delta Plan, to respond to the consequences of climate change and to ensure the sustainable socio-economic development*".

Dutch knowledge institutes involved in the Mekong Delta Plan are Wageningen University and Deltares.,

Cooperation with Denmark

The South Driven Research Cooperation Programme (earlier Pilot Research Cooperation Programme) . The objective of the Programme is to strengthen research capacity in Vietnam within Climate Change, including applied technology. The Vietnamese research institutions are responsible for defining and managing the research projects. The projects are carried out in cooperation with Danish research partners. Danida Fellowship Center (DFC) is overall responsible for the administration of the Programme on behalf of the Danish Ministry of Foreign Affairs.

Cooperation with France

For over twenty years CIRAD has collaboration with Vietnam on numerous projects: supply chain socioeconomics; livestock and crop production; animal health and epidemiology; food sanitary quality; agro-ecology in upland regions; biodiversity; natural resource management, particularly water and soils; and information and communication sciences.

Furthermore CNRS has extensive collaboration with Vietnam

Cooperation with Germany

Germany and Vietnam have very good political relations; within Europe Germany is the most significant trade partner. In October 2011 the good bilateral relations between Vietnam and Germany were cemented by the Hanoi Declaration, a partnering and cooperation agreement, signed by Federal Chancellor Angela Merkel and Prime Minister Dung.[1]

For the German Federal Ministry for Economic Cooperation and Development Vietnam is an important partner in development cooperation. It focuses on the following three priority areas:

- vocational training
- the environment (biodiversity and coastal protection)
- energy (energy efficiency and renewables)

[1] AA (2014)

Germany is supporting Viet Nam's Green Growth Strategy.[1]

The relevant development programmes are conducted by Germany's two major implementing organisations: the KfW Development Bank and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). These organisations are funded by and operate on behalf of the Federal Government of Germany. The German Academic Exchange Service (DAAD), the Alexander von Humboldt Foundation and the German Research Foundation (DFG) have academic contacts and cooperation agreements with Vietnam. It is a priority country in efforts to make Germany internationally more attractive as a place to study.[2]

The Federal Ministry of Education and Research (BMBF) maintains close contacts with Vietnam's Ministry of Science and Technology (MoST). In the area of scientific and technological cooperation there is extensive exchange at both scientific and political levels.

The BMBF and the MoST jointly run an "MOST-BMBF-Office for Research Cooperation on Water and Sustainability in Hanoi. It supports both ministries in implementing projects for research and development related to sustainable production, notably water usage, technical environment, and rational use of natural resources. [3]

Ground breaking for the Vietnamese academic landscape was the opening of the Vietnamese-German University as one of the „New Model Universities" in Ho Chi Minh City in September 2008 At present the university has more than 750 students. With the financial support of e.g. the World Bank and the BMBF an academic institution is built up following the high educational standard and quality of Germany.[4]

The Vietnamese-German Centre is a co-operation project between the Hanoi University of Science and Technology (HUST) and the German Academic Exchange Service (DAAD). It was built with the support of the German industry and the Federal Government of Germany. The center aims to promote scientific and technological exchange and to develop close links with the international business community. Besides, the center accommodates the Hanoi Branch Office of German Academic Exchange Service (DAAD) as well as the German Department of Hanoi University of Science and Technology. [5]

[1] BMZ (2014)

[2] AA (2014)

[3] VD (2013)

[4] AA 3 (2014)

[5] AHK Vietnam (2014)

13.7 Connections between Water JPI SRIA and the RDI programmes and policies of Vietnam

SRIA Questions	Rate (1 to 6)	Brief motivation of the rating
Sustainable ecosystems	5	Awareness on natural resources is strong, research strategy includes it
Developing safe water systems for the citizens	6	Much effort is done to improve infrastructure in rural and urban areas
Promoting competitiveness in the water industry	4	
Implementing a water-wise bio-based economy;	4	
Closing the water cycle gap	4	

(Based on own estimations)

13.8 Acronyms of VIETNAMESE institutions and reference documents

Acronym	Institution Name	Website
BMBF	Federal ministry of Education and Research (Germany)	www.bmbf.de
DAAD	German Academic Exchange Service	https://www.daad.org/
HUST	Hanoi University of Science and Technology	www.hut.edu.vn/
MARD	Ministry of Agriculture and Regional Development	www.vietrade.gov.vn
MoC	Ministry of Construction	www.xaydung.gov.vn
MoH	Ministry of Health	http://www.moh.gov.kh
MoIT	Ministry of Industry and Trade	www.moit.gov.vn/en
MONRE	Ministry of Natural Resources and Environment	http://icem.com.au/portfolio_category/ministry-of-natural-resources-and-environment-of-vietnam-monre/
MoST	Ministry of Science and Technology	http://www.most.gov.vn/Desktop.aspx/Home-EN/
MPI	Ministry of Planning and Investment	http://www.mpi.gov.vn/portal/page/portal/mpi_en
VAST	Vietnam Academy for Science & Technology	http://www.vast.ac.vn/en/
VIWRR	Vietnam Institute for Water Resource Research	
	AA (2014): Auswärtiges Amt Federal Foreign Office Germany. Key word: Politische Beziehungen.	http://www.auswaertiges-amt.de/DE/Aussenpolitik/Laender/Laenderinfos/Vietnam/Bilateral_node.html
	AA 2 (2014): Auswärtiges Amt Federal Foreign Office Germany. Key word: Wirtschaftslage.	http://www.auswaertiges-amt.de/DE/Aussenpolitik/Laender/Laenderinfos/Vietnam/Wirtschaft_node.html
	AA 3 (2014): Auswärtiges Amt Federal Foreign Office Germany. Key word: Bildung.	http://www.auswaertiges-amt.de/DE/Aussenpolitik/Laender/Laenderinfos/Vietnam/Kultur-UndBildungspolitik_node.html.
	AHK Vietnam (2014): Delegate of German Industry and Commerce in Vietnam. Key word: Vietnamese-German Center.	http://www.vietnam.ahk.de/unternehmen/vietnamese-german-center-vdz/
	ADB (2010): Viet Nam Water and Sanitation Sector Assessment, Strategy and Roadmap. Southeast Asia Department Working Paper. Asian Development Bank.	
	BMZ (2014): Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung. Federal Ministry for Economic Cooperation and Development. Key word: Relations	http://www.bmz.de/en/what_we_do/countries_regions/asien/vietnam/index.html

	DECREE VN (2013): Defining the functions, tasks, powers and organisational structure of Ministry of Science and Technology. Vietnam. No: 20/2013/NĐ-CP.	http://www.most.gov.vn/Desktop.aspx/Introduction/Functions-and-tasks/Functions_and_tasks/

ANNEX I: EXTENDED METHODOLOGY BIBLIOMETRIC ANALYSES

Publications

The bibliometric analysis of Water Research and Development performance in for the seven target countries (Brazil, Canada, China, India, South Africa, USA, and Vietnam) was based on the analysis of publications from 1998 to 2012 (15-year period), compiled from the Web of Science® (WoS) in December 2013.

The five research questions expressed in the Water JPI Strategic Research and Innovation Agenda (SRIA) were formulated in terms of WoS search strings as follows:

Code	Question	WoS Search String
Q1	Maintaining **Ecosystem** Sustainability	water AND (ecosystem OR ecohydrology OR "ecological engineering" OR flood OR drought OR "early warming" OR "ecosystem service")
Q2	Developing safe water systems for the **citizens**	water AND (urban OR "emerging pollutants" OR "flood" OR "drinking water" OR "water treatment" OR "water distribution" OR "water storage")
Q3	Promoting competitiveness in the water **industry**	water AND (industry OR distribution OR measurement OR telemetry OR "remote control" OR reuse OR desalination OR sewage OR sludge OR "economic instrument" OR governance OR regulatory)
Q4	Implementing a water-wise **bio-based economy**	water AND (bio-based OR bio-economy OR bioeconomy OR agriculture OR (irrigation NOT clinical) OR forestry OR (non-point AND pollution))
Q5	Closing the water cycle **gap**	water AND ("water supply" OR "water demand" OR "water deficit" OR transboundary OR "sustainable" OR (hydrolog* AND model*) OR ("managed aquifer recharge") OR ("soil-aquifer treatment") OR (socio* AND econom*) OR "decision support system")
All topics		hydrology OR (Water AND agriculture) OR (irrigation NOT clinical) OR (river AND basin) OR watershed OR flood OR drought OR ((urban OR municipal OR residential OR treatment) AND water) OR ((industry OR industrial) AND water)

For each target country, water publications were systematically obtained for each Question and for the general Water topic by using three simultaneous WoS search fields:

- Topic (Question),
- Address (Country), and
- Year published (1998-2012).

Publications were expressed as:

1) Ratios per inhabitants and per Gross Domestic Product (GDP). The number of inhabitants was obtained from Wikipedia and the GDP was obtained from the List by the United Nations (2012) accessed in http://en.wikipedia.org/wiki/List_of_countries_by_GDP_%28nominal%29; and
2) Percentage respect to the same ratio applied to Europe. In this work, Europe was considered as the addition of the 28 Members States (MS) and the 12 Associated Countries to the Framework Programme (AC).

Data analysis

For each third country, publication records retrieved from the general question (All topics) were analyzed using the following WoS fields:

- Countries /Territories. This selection answers to the question "Who is publishing with?" and reveals which other countries are cooperating with researchers from third countries, allowing us to evaluate the international collaboration in water publications. Europe (MS+AC) was determined as a single value to evaluate its international collaboration capacity in the world ranking. National European values were equally assessed;

- Funding Agencies. This selection answers the question "Who is funding this research?" The name of the main agencies was previously homogenized (via web searches as far as possible) due to the variety of names used in different publications for the same Institution. The percentage of publications per Funding Agency was recalculated based on the sum of the first 25 items as a maximum. This sum varied from 46% for China to 12% for India or USA; and

- Organisations. This selection answers the question "Which Institutes are doing the work?" The results disclose the most active institutions in each country.

Finally, for each third country, the publications obtained for each Water JPI SRIA research question (Q1 to Q5) were analyzed by Organisation and Author. Results retrieved indicate who is leading the research in every topic and which the performing organisations are.

For all the above inquiries, the results were expressed as percentage from total publications, and only the first five ranked items were displayed.

Indexes

To evaluate the differences in water publications among third countries along the 15-year period analyzed, and for comparisons among countries, we established the following indexes.

- The Increase rate of publication. This rate was calculated as: 1) absolute value: the number of publications from the three last years of the analyzed period divided by that of the three first years; and 2) relative value: the absolute Increase rate of the country divided by the same absolute value applied to Europe (MS+AC), expressed in percentage. This index express how fast water publications are increasing in time in the third countries respect to Europe (MS+AC).

- Index of Collaboration. This rate indicates how often researchers from third countries publish with colleagues in other countries. This index was obtained from the analysis of publications by countries. Due to the frequent occurrence of more than one foreign author in a publication, these indexes do not reflect the percent of publications with international

cooperation. As a consequence, they should mainly been used to establish comparisons among countries. Two indexes were calculated:

- The Index of International Collaboration, established as the frequency of authors from other countries in the water publications of the target country, expressed as a percent; and
- The Index of European Collaboration, the frequency of European authors (Member States and Associated Countries) in the water publications of the target country, expressed as a percent.

Comparative Results

Water publications produced by the third countries represent the following percentages respect to Europe (MS+AC):

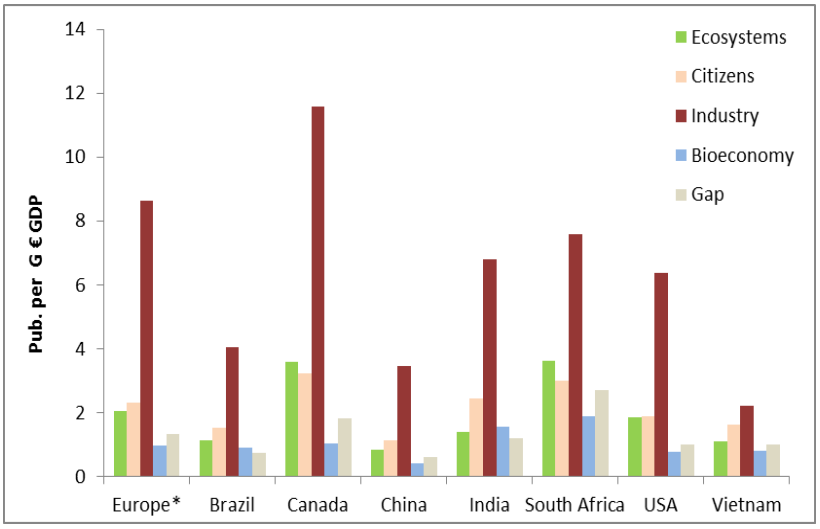
Third Country	M inhab.	G € GDP	% Pub. Respect Europe (MS+AC)	
			Number	Per G € GDP
Brazil	201	1,645	10	97
Canada	35	1,329	14	153
China	1,350	6,101	28	49
India	1,210	1,369	11	160
South Africa	53	280	3	134
USA	317	11,858	71	87
Vietnam	90	114	0.4	48

Europe (MS+AC) leads publications in the field of Water. USA shows the highest percentage of publications respect Europe (MS+AC) together with the highest GDP.

The GDP difference among the target countries is very large: 104 times between the maximum (held by USA) and the minimum (held by Vietnam). The analyzed countries show a difference of 178 times in percent publications respect Europe. When analyzing percent publications per GDP, the maximum difference between countries is reduced (3.3 times), with the extreme countries being India (maximum, 160%) and Vietnam or China (48% and 49%, respectively).

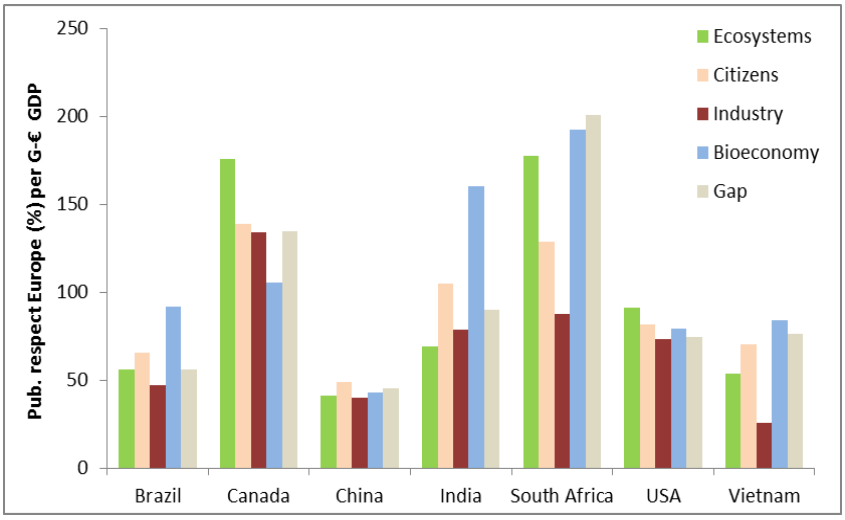
World production of publications in Water JPI SRIA five main topics

The standardized values (rate of publications per GDP) show that Industry is the field with the highest rate in all countries. This may be related to the search strings used for the analyses. Canada is above Europe (MS+AC), and Vietnam, China and Brazil, show low and similar rates.



General production of Third Countries in Water JPI publications respect Europe

The main strengths were observed in South Africa and Canada, which surpass the European (MS+AC) publication rates in almost all the fields of Water JPI SRIA. India surpasses Europe (MS+AC) in Bioeconomy.



Temporal evolution in the 15-year period

China shows the maximum absolute increase rate, 9 times higher than Canada and USA. Brazil and Vietnam follow with a medium absolute increase rate.

China has experienced almost 800% of European (MS+AC) increase, followed by Vietnam, with 284% and Brazil, 260%.

Europe (MS+AC) increase is also below that of South Africa and India.

More developed countries show lower increase rates in the analyzed period.

Third country	Absolute Increase Rate	Increase Rate %Relative to Europe (MS+AC)
Brazil (All)	6	260
Canada (All)	2	84
China (All)	18	792
India (All)	4	153
South Africa (All)	3	111
USA (All)	2	74
Vietnam (All)	7	284

International Cooperation

USA researchers publish with the highest number of foreign colleges, from 177 different countries, and Canada follows with 137 countries. Minimum cooperation is observed for Vietnam, with only 54 foreign countries.

The maximum International Collaboration Index of is held by South Africa (55%) and Canada (53%). For the other countries the index is slightly lower, and India shows the lowest cooperation with foreign countries (26%). Vietnam is an exception, with an index of 139% resulting in more articles signed by foreign colleges than by Vietnamese authors. This contradiction arises from the WoS analysis design (restricted to the first author), and is interpreted as the high number of foreign co-authors per article.

When analyzing the cooperation of third countries with European countries (MS + AC), USA shows the maximum European Collaboration Index, cooperating with researchers from 36 European countries. The maximum European Collaboration Index is for Vietnam (60%) again, and South Africa follows with 24%, whereas India and China have the minimum European Collaboration Index, <9%.

Country	International Collaboration		EU(MS+AC) Collaboration	
	No. Countries	International Collaboration Index, %	No. EU(MS+AC)	EU (MS+AC) Collaboration Index, %
Brazil	107	31	32	14
Canada	137	54	32	19
China	111	30	31	8
India	116	26	27	9
South Africa	98	55	27	24
USA	177	35	36	14
Vietnam	54	139	21	60

Who is publishing with?

Europe (MS+AC) is the main international collaborator of third countries, with a percentage of cooperation ranging from 60.8% with Vietnam to 8.1% with China. China is an exception, having USA as first collaborator. USA is the second leader on International cooperation with the other third countries, 10% as mean. Australia and Canada are also common collaborators, and Japan is the second cooperator country with Vietnam.

Among European countries, Germany, France and UK lead the cooperation with third countries.

Who is funding this research?

The respective National Councils (Research, Science, Engineering, Technological, or Industrial) and National Science Foundations (China, USA) are the main Institutions funding the research of third countries. An exception is Vietnam, with the MINISTRY OF FOREIGN AFFAIRS OF DENMARK as main founding Institution.

EU also founds research for Vietnam (7.6%) and South Africa (4%). China is financing research of Canada (3.6%) and USA (6%); and Japan and France (IRD) are financing Vietnamese research in the field of Water (6.5% and 4.3%, respectively).

Which Institutes are doing the work?

Universities are the main institutions performing the research in Water topics in Vietnam being CANTHO UNIV the most involved (10.9%).

In USA, ARS and US Geological Survey are the main institutes doing the work in Water research and innovation.

In South Africa, the role is shared with similar participation of the main Universities (Pretoria, Cape Town, etc.). Similar situation occurs in Brazil (Sao Paolo, Estadual Paulista, Estadual Campinas, etc.).

India is performing the research in Water in two main institutions: the Indian Institute of Technology and the Council of Scientific Industrial Research.

The Chinese Academy of Sciences is the main institution in China (24.4%), whereas in Canada the role is shared between Universities (Alberta, British Columbia, etc.) and Environment Canada.

Who is leading?

In terms of Organisation leading the research of each Water topics, Brazil shows the University Sao Paulo as the main leader in all the topics (from 25% to 16%). Similar situation is shown by China, with the Chinese Academy of Sciences as main leader (from 26% to 38%).

For Canada, South Africa, and Vietnam, the leadership is shared with a similar participation of the different Universities. India shows an analogous situation though the Council of Scientific Industrial Res CSIR is in the first position for almost all Water topics. USA ARS detached in Q4 (Bioeconomy).

The authorship is very shared, with percentages usually below 3% in all topics, detaching VIET PH (10.8%) in Q2 (Citizens) Vietnam, and HUGHES DA (5%) in Q5 (Gap) South Africa.

ANNEX II: DESCRIPTION OF WORK WP 5

Workpackage 5: Coordination with activities outside Europe

WP number:	WP5		Start date or starting event:			M1
WP title:	Coordination with activities outside Europe					
Activity Type:	COORD					
Partic. Number:	1	2	3	4	5	6	7
Partic. name:	MINECO	FCT	IRSTEA	NERC	RVO.nl (Former NL Agency)	ISPRA	DN
Person-months:	5.0		2.0	0.8	9.1	1.0	
Partic. Number:	8	9	10	11	12	13	14
Partic. name:	AKA	EPA	UEFISCDI	RPF	ONEMA	SUEN	RCN
Person-months:						1.0	
Partic. Number:	15	16	17	Total WP person-months:			23.6
Partic. name:	BRGM	MoE	JÜLICH	Total Participants:			9
Person-months:	1.9	0.8	2.0				

Objectives:

Limitations in the common European strategy for international RDI cooperation have often led to duplication of effort, with resulting inefficient use of resources and reduced impact. Increased coordination will benefit both Europe and partners outside Europe. Key WP5 objectives include:

I. Strengthening the international dimension of European Water RDI.

II. Developing durable partnerships for Water RDI in the world.

A more coordinated and consistent approach in international RDI cooperation between European Member States will help build the critical mass needed to provide an effective response to major societal challenges as formulated in the Water JPI Vision Document. It will also enable Europe to participate more effectively in agenda setting in international water *fora* and to convey consistent messages.

In order to complete the activities of this WP, Water JPI cooperation with the Strategic Forum for International S&T Cooperation (SFIC) will intensify. This cooperation will ensure coherence of the Water JPI with European policies for international scientific and technological cooperation.

Description of work:

Task 5.1. Mapping Water RDI initiatives run by Water JPI partners outside Europe. (Lead: RVO.nl

(Former NL Agency); **Participants: MINECO, NERC, ISPRA, SUEN, BRGM, MoE, JÜLICH)**

European countries and the EC have a longstanding tradition in Water RDI cooperation with countries outside Europe. In a first step, WP5 will identify the most relevant Water JPI players outside Europe, gathering information about their RDI programmes, agendas, activities, instruments, investments, target countries and the impact of such activities. In a second step, relevant RDI programmes of selected non-European countries will be mapped following the same criteria. This mapping exercise will use a similar framework as the mapping produced in WP2, although its intensity will be lower. Analysis of the gathered information will permit determination of gaps and overlaps highlighting missed opportunities. Analysis will also lead to the identification of a list of potential countries for interaction with the Water JPI.

Task 5.2. Develop and sustain strategic alliances outside Europe. (Lead: RVO.nl (Former NL Agency)**; Participants: MINECO, IRSTEA, NERC, ISPRA, SUEN, MoE, JÜLICH)**

Task 5.2. Develop and sustain strategic alliances outside Europe. (Lead: RVO.nl (Former NL Agency); Participants: MINECO,IRSTEA, NERC, ISPRA, SUEN, MoE, JÜLICH) Alliances will be sought with RDI programmes of countries outside Europe, in close coordination with SFIC. Alliances will progress towards the signature of specific Memoranda of Understanding (MoU) oriented towards the participation of third Countries in specific Water JPI activities. Therefore, the process of Joint Programming will be expanded to selected countries and for specific activities. Target countries for Task 5.2 will be selected following a number of criteria, based on mutual interest and mutual benefit:

• Synergies in the production of scientific and technological breakthroughs;

• Information exchanges on specific research and development needs;

• Technology adaptation to local conditions;

• Pilot testing European technology; and

• Internationalisation of policy developments in water management.

Following these criteria, target countries may include developed countries (i.e., the USA and Japan), emerging countries (such as the BRIC countries), neighbourhood countries or developing countries. The international dimension of the Water JPI started with SFIC in India. The Europe-India link is expected to lead developments in this WP. In addition to India, three additional target countries will be explored, based on the mapping performed

in Task 5.1. The Water JPI Governing Board will decide the final list of countries. At least one country outside Europe will take part in the Joint Activities under Task 4.4.In order to facilitate fruitful development of RDI cooperation, specific framework conditions will also have to be addressed in this WP. In particular, funding arrangements and IPR agreements will be adapted to satisfy both European and non-European partners.